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17. ABSTRACT (MAX. 250 WORDS)

After an evaluation made by the teachers of kindergarten through grade 6, the following areas of clarification, rewriting, or additions were indicated: The purpose and use of the science guide; evaluation of the units by grades; additional materials for the units; a rewriting of particular units; health units for grades one through five; the use of textbooks; and the central role of the teacher.

The remainder of the document consists of units of study. Kindergarten units include: Health, Science, and Safety through a Kindergarten Child's Day. Resources, films, filmstrips, and a bibliography are given for the teacher's use. First grade units are: Plants, Animals, Our Earth, The Universe, Simple Machines, and Health Habits. Second grade units include: Seasons, Plants and Animals, Sound, Weather, The Solar System, and Food and Nutrition.

Third grade units listed are: Seeds, Animal Ways, Air Magnets, Electricity, and Health. The units for fourth grade are: Earth's Rocky Crust, Plants, Water, Machines, Our Solar System, and First Aid and Safety. Fifth grade units include: Weather, Ancient Plants and Animals, Matter, Heat, Animals, and Disease Control and Prevention. The sixth grade units included are: Atomic Energy, Electricity, The Universe, Aviation, and the Human Body. No additions were made to the Kindergarten unit. In the first, second, and third grades no units were changed, but a health unit was added. All fourth grade units were broadened and a new health unit on First Aid was included. Fifth grade units were enlarged with a new unit written for Matter and Energy and a new health unit. Sixth grade units were revised and broadened, a new unit on The Universe was written, and a health unit was revised to include all the major systems of the body.

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ERIC Form 1

A SCIENCE PROGRAM
FOR THE ELEMENTARY SCHOOLS
OF LOWER MERION SCHOOL DISTRICT

Ardmore, Pennsylvania

September, 1962

PHILIP U. KOOPMAN
Superintendent

U. S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
Office of Education

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ED002392

ELEMENTARY SCIENCE REVISION - 1962

When a SCIENCE PROGRAM FOR THE ELEMENTARY SCHOOLS OF LOWER MERION SCHOOL DISTRICT, 1959, was issued, all teachers using the units were asked to evaluate them as they were taught. Six hundred and three evaluation sheets, covering all twenty-nine units, were analyzed and form the basis of this revision.

The following areas of clarification, rewriting, or addition were indicated:

1. Purpose and use of the science guide.
2. Evaluation of the units by grades.
3. Additional material for units.
4. Rewriting of certain units.
5. Health units for grades one through five.
6. Use of textbooks.
7. Central role of the teacher.

1. PURPOSE AND USE OF THE SCIENCE GUIDE

Although the large majority of the evaluations were favorable, comments that units were too long, too short, too difficult, or too simple were fairly common. In some of these cases the implication was clear that the teacher had followed the guide literally, step by step. Perhaps we did not make the purpose of the guide clear enough.

A basic apparent paradox in any guide involves concreteness versus creativity. In order to promote sequence and completeness, we need specific content; in order to teach well, we need spontaniety and creativeness.

For this reason our science guide, although very specific, actually gives a teacher wide latitude. The concepts assigned attempt to cover the field of elementary science in a sequential manner and should be taught. The activities offered to implement these concepts are suggestions that may or may not be used.

For example, the first grade is assigned "Animals," "Plants,""The Universe," "Our Earth," and "Simple Machines." A teacher may decide to combine these units. During a thorough unit on the farm, children may be taught such concepts as animals have needs that must be cared for, plants can be started in many ways, living things need each other, there are many kinds of soils, a machine is a thing that helps to do work, and so on. Indeed, with care all the assigned concepts could be covered in this general context if the teacher is so inclined. Conversely a teacher may teach the units separately or combine them in some other manner.

In other cases, combining units may be less desirable or even possible. This is particularly true if the teacher is dealing with diverse material that he feels less secure about. In such cases the approach may parallel the suggested methods closely.

The main point is that the science guide is designed to help you present your part of the broad spectrum of elementary science to our children. In order to make full use of it, you will find it necessary to adapt it to your needs.

2. EVALUATION OF THE UNITS BY GRADES

A brief discussion of the material assigned each grade and the evaluation of each unit by grade is offered together in an attempt to help you relate each unit and your year's work to the total picture of elementary science.

3. ADDITIONAL MATERIAL FOR UNITS

Suggestions and additional material offered by teachers have been edited and arranged on separate sheets of paper.

4. REWRITING OF CERTAIN UNITS

In some cases it seemed best to make fundamental changes in certain units. These new units replace the older ones. For example, the sixth grade unit on "The Universe" was thought to be too intangible. It has been rewritten and many concrete activities have been added. The fifth grade unit "Matter and Energy" was thought to be too comprehensive. Two new units "Matter" and "Heat" replace it completely.

5. HEALTH UNITS FOR GRADES ONE THROUGH FIVE

New health units for grades one through five have been written. The sixth grade unit "The Human Body" has been revised and expanded to include all the major systems of the body.

6. USE OF TEXTBOOKS

The original guide keys the concepts of each unit into various levels of three textbook series - Ginn, Heath, and Scott Foresman. This is necessary since the material presented in each unit covers several levels in all three textbooks series. It is impossible to follow the course of study and use one basic textbook, unless the basic textbook itself is supplemented.

7. THE CENTRAL ROLE OF THE TEACHER

The evaluation sheets testify in striking fashion to the importance of the teacher. His philosophy, sympathy, understanding, and ability often glow from the paper, much the same, we would imagine, as in the classroom situation itself.

Lower Merion School District

The science units developed for use in the Lower Merion elementary schools attempt to provide a comprehensive science curriculum beginning in the kindergarten, extending through the sixth grade, and preparing for the continuation of a pupil's science study in the junior high school. The units try to translate the ideas, suggestions, and recommendations presented to the subcommittee by the Elementary School Science Committee composed of parents, teachers, and administrators, into a program that stimulates each pupil's interest and challenges him to use whatever abilities he may have. This committee met periodically during the school year 1958-59. The members of the committee to whom the subcommittee is greatly indebted were:

David M. Ashkenaz, Ph. D.
Herbert B. Callen, Ph. D.
Mrs. Ann Hughes, M. D.
Robert Blough
Alfred Castaldi
Harvey Cook
Mrs. Irene DeHoff
George W. Ferguson
Mrs. Phyllis Fraunfelder
Eugene Kessler
Marlin Kessler
Merle A. Knecht
William Miller
Eleanor Rugh
Mrs. Sarah Supplee
Mildred Zink

The units are guides designed to help teachers to provide a study of science appropriate for the kind of pupils who attend the Lower Merion schools. They attempt to make use of our knowledge of our students as well as the research findings concerned with the teaching of science in the elementary schools.

One topic LIVING THINGS is included as part of the work for each grade. Each unit concerned with this topic builds upon the work of the preceding one and leads to the next. The units show how continuity can be secured in studying one area year after year. To provide children who have the interest and the ability with the opportunity to study a subject as much as they want to without fear of doing work reserved for another grade, a few units have been assigned to one grade only. Other units such as the one on astronomy have been developed for every other year with a view to providing boys and girls with opportunities to study a phase of science at a greater depth than would be possible if it were studied each year and with the knowledge that certain aspects of the topic can be studied more adequately and more effectively as the pupils grow older.

The units are listed by grades.They may be taught in the order presented or in any sequence desired by the teacher. It is hoped that the teacher will also incorporate incidental teaching of the current-event-inspired-type, which frequently stems from the children's questions about the news of the day. His judgment should determine the depth and time alloted to such consideration.

Experiences, activities, and factual materials are included for the purpose of alerting the child to observe phenomena around him; to furnish him with authentic knowledge on which to build from grade to grade; to enlarge his curiosity as well as his field of information; to sow the seeds of widening interests. By developing the concepts as logical conclusions to motivated observations, activities and experiments, the child will grow in confidence and maturity.

Specific activities are listed and keyed (by numbers) to coincide with the concepts as listed. In every instance possible, the child, rather than the teacher, should conduct the activity and be encouraged to suggest others suitable to the occasion. The teacher will serve as a guide to check the accuracy of the child's work. Since the CONCEPTS, written in CAPITALS, are meant to be deduced by the children, they are expressed in the language of the children. The subdivisions, on the other hand, are for the teachers' use and are styled accordingly. As you can readily see through your examination of any of the units, the method of development is based on the deduction of large concepts by the child rather than on a presentation of those concepts by the teacher. The method should produce effective thinking on the part of the pupils.

As the teachers should relate their instruction whenever possible to the environment, so they should encourage the children to bring materials for the units from their immediate surroundings.

The activities, resources, and bibliography listed with each unit should be expanded by the teacher. It is understood that each school will vary its use of the listed activities and resources to meet the needs of the pupils it serves.

The units have been keyed to three textbook series as follows: 1- Ginn, 2 - Heath, 3 - Scott Foresman. The second number in the references to textbooks denotes the book, or grade, of the series. The numbers following the colon designates the pages in the book covering the topic. Thus 2 - 6: 164 - 171, when translated means that the topic is discussed on pages 164 - 171 in Book 6 of the Heath series.

Since the work covered in a unit may be treated in the textbooks at different levels, it is important that teachers make certain that the pupils are able to read the materials withou frustration due to the lack of reading ability. No child should be permitted to develop a distaste for science because he cannot read a particular reference listed.

So that a teacher will not work intensively on aspects of the program assigned to another grade, each teacher is being given copies of the units of the grade below and above that which he is teaching. This precaution does not preclude the consideration of information that is introduced in a current-event approach. For your information a grade level listing of all the units developed this summer is included.

It will be helpful if teachers bear in mind that they and the children should interpret scientific terminology accurately in the words of science. Since scientists disagree on some of the theories discussed in these units, it would be well to teach them as theories.

Equipment and textbooks, acquired to supplement the materials already on hand, will be centrally located in each school. The successful use of them will depend largely upon the whole-hearted cooperation of all teachers.

All teachers using these units are asked to evaluate them throughout the year, to keep a record of the aspects they stress, to note the reactions of the pupils, and to list additions they found necessary. Each is urged to communicate to the member of the Elementary School Science Committee representing his school any suggestions for revision of the units that he may have. Mr. Marlin Kessler is available as a consultant. From time to time the Elementary School Science Committee will meet to consider your comments about the units.

It has been the goal of this committee, as it is that of every parent and teacher, to maintain and stimulate the child's interest in learning about science, to help him realize that science is not something apart but is rather a part of his every living moment and a part of American culture.

These units are submitted to you, the teachers, who will exert much of the influence that will determine the success in science of the boys and girls under your guidance, with the hope that they will help you immeasurably in providing the highest quality science instruction possible in our school district.

Members of the Summer Committee are:

Alfred Castaldi
Roberta Christie
George Ferguson
Marlin Kessler
Mabel Penman
Theodora Wilbur

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Elementary Science Revision 1962
Evaluating the Units
Kindergarten

The science guide for kindergarten is not as formal as for the other elementary school grades. Concepts from the fields of elementary science, health, and safety are listed, but their development is left to the discretion of the teacher. At no level is the central role of the teacher more crucial. It is in the kindergarten that many of the basic attitudes toward the formal learning situation begin to form. Depending on the skill of the teacher, the natural inquiring aspect that most children bring to school can be natured or its growing edge dulled. Since most learning by the child has been of a spontaneous nature up to this time, it was felt that as much freedom as possible should be given our teachers at this level.

The kindergarten teachers were enthusiastically endorsed to the unit, "Science, Health and Safety Through a Kindergarten Child's Day." Therefore, no changes were made in it.

Additional suggestions that were made by our teacher appear at the bottom of this page.

Additional Suggestions for Teaching The Unit

Activities

The kindergarten publication Weekly Surprise, with its pages "Our Big World and Science" fits in well with this program. It is well planned, child like, timely, and interesting.

WFIL Schoolhouse, Channel 6, 11:00 A.M., is particularly adapted to kindergarten in the area on health.

SCIENCE, HEALTH AND SAFETY THROUGH A KINDERGARTEN CHILD'S DAY

The immediate aim of the kindergarten program is to introduce the child to the complex group life of which he has now become a part. Building upon his pre-school experience, an environment is provided, insofar as is possible, in keeping with that of his home.

New learnings develop as the child becomes acquainted with the school environment beyond his immediate room. He walks through the building; he sees other groups of children working; he sees how other school workers contribute to his school life. His explorations continue beyond the building. He learns where to play, how to respect and to help care for the beauty of the grounds. He becomes acquainted with the policeman at the corner.

Science experiences in kindergarten should broaden the child's interest, stir his curiosity toward further research, develop his ability to observe, and to make simple generalizations.

This program has purposely been prepared with general statements to coincide with the flexible, incidental learnings for this age level. It will be left to the discretion of the teacher to develop any or all of the subject areas in detail, or merely to touch them lightly.

CONCEPTS

Everyone should eat a good breakfast.
It is important to brush teeth after meals.
We should dress according to the weather.
Outdoor play after school is necessary.
Exercise helps the body grow.
Washing ourselves helps to protect us from germs.
A bath before going to bed affords a good opportunity to do a more thorough job of washing.
It is important to get sufficient rest if we are to maintain health and enjoy our work and play.
GOOD HEALTH HABITS HELP US DO BETTER WORK IN SCHOOL.

Traffic lights are used as signals.
It is important to obey traffic lights.
Policemen and patrols are at street crossings to protect you.
It is important to obey rules when on the school bus.
It is safe to play in yards, on side walks, or on the playground.
It is safer for everyone if things are picked up and put where they belong.
SAFETY RULES ARE TO KEEP US SAFE.

You can see changes taking place.
Plants and animals change with the seasons.
There are changes in the length of day and night with the changes in seasons.
The sun is in a different position in the sky at different times in the day.
We make a shadow when we block out some light.
Shadows are of different lengths at different times of the day.
CHANGES TELL US MANY THINGS.

Some light things float in water.
Some heavy things can float in water.
Some heavy things sink.
The seesaw can help you lift someone into the air.
All seesaws rest on a support near the center.
Two children of equal weight will balance perfectly.
We cannot see air, but we can feel it and see what it does.
Moving air is wind.
Wind can move things.

WE CAN SEE MANY INTERESTING SCIENTIFIC FACTS AROUND US.

Plants need water, light, minerals, and warmth.
Most plant roots grow down and the stems, with leaves, grow up.
Pets need proper food and water.
Pets need daily care.
Animals build the kind of homes that are best for them.
Birds build nests for their young.
Many ants live together.

PLANTS AND ANIMALS HAVE NEEDS WHICH WE CAN HELP TO CARE FOR.

RESOURCES

1. Local pet shop
2. Farm
3. Dairy
4. Philadelphia Zoo or Norristown Zoo

RESOURCE PEOPLE

1. Policeman
2. Bus driver
3. Gardener
4. Pet shop owner
5. School murse
6. Dentist
7. Doctor
8. Patrol leaders in school

FILMS

Care of Pets -	Radnor Film Library
Lazy Lucy	" " "
Play in the Snow	" " "
Primary Safety on the Playground	" " "
Safety on our School Bus	" " "
Sleep for Health	" " "
Snow Suit Time	" " "
Wy the Cow Came Back	" " "

FILMSTRIPS

Finding Out How Plants Grow -	SVE
Finding Out How Animal Babies Grow	"
Finding Out How You Grow	"
Safe and Sound At School	"
Safe and Sound Along the Way	"
Safe and Sound at Home	"
Safety To and From School -	Curriculum Filmstrips
Safety at School	" "
Safety in the Playground	" "
Safety At Home	" "

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ELEMENTARY SCIENCE REVISION - 1962

EVALUATING THE UNITS

FIRST GRADE

Gerald Craig wrote, "It is most important for the success of our way of like that children have a good feeling toward science. Science should not seem foreign or exotic to them. ...Science is the result of man's experiences and logical thinking through the centuries. Science, like democracy or the mother tongue, belongs to all who wish to make use of it. Children should be made to feel that science belongs to everyone."[1]

The science referred to includes more than the traditional nature study. It includes the world of non-living things -- the earth's crust, the atmosphere, the solar system, the universe. It also includes the world of energy -- heat, light, magnetism, machines, atomic energy, etc.

The first grade units "Animals" and "Plants" are an introduction to Living Things; "Our Earth" and "The Universe"are introductions to Non-Living Things; "Simple Machines" introduces our children to the world of Energy. In each grade these three years are repeated. In order for our children to grow naturally into an awareness and an acceptance of science, they should get a balanced view of it from the beginning.

According to the evaluation sheets, "Animals" and "Plants" appear to be naturals for first gaade. Almost every teacher evaluating these units was highly enthusiastic.

"The Universe" was another matter. From the teacher's reports, this unit cannot stand alone. Actually it was originally conceived as a bridge between Living and Non-Living Things, but this was not explained. At any rate, at least two successful ways of handling this unit have evolved. Some teachers covered the material in a few days as an introduction to all the units, while others combined "The Universe" with "Our Earth."

The evaluations of "Simple Machines" and "Our Earth" were similar and show that the reaction of the children was varied. Many teachers reported success from beginning; others said that by the second year the response of the children had definitely improved. The growing knowledge and interest of the teachers undoubtedly contributed heavily to this improvement. As the years pass and we become more proficient in these areas the reports will probably continue to improve.

No changes were made in any of the first grade units. Additional suggestions that were made concerning the units appear on the following sheet.

The new first grade health unit "Health Habits" is also included.

---

[1] National Education Association, Science For Today's Children, 1952.

Additional Suggestions for Teaching The Units

ANIMALS

The Norristown Zoo seems particularly well suited to young children. It is small enough to cover in one visit and yet has a variety of animals.

Through the material in this unit children can be taught kindness, gentleness, and protectiveness. Children love to feed and care for animals; it makes them feel important.

The question of whether or not to set up an aquarium complete with filter, heater, and lights has been answered in the affirmative by a surprising number of teachers. It is quiet, clean, and clear. Both plant and animal life can be observed. Taking care of it is a valid class project.

Such different animals as dogs and dinosaurs were used for a more detailed study of animals at this level. Comparisions, within each species, of size, shape, weight, habits, etc., were made.

Children seem particularly interested in the names of young animals - calf, piglet, colt, chick, lamb, fawn etc.

Films, pictures, books, stories, dioramas were all used, and successfully, but they are still poor substitutes for the real thing - live animals.

PLANTS

Use the soil brought in for the earth unit to plant seeds. Notice the effect of different kinds of soil on the plants.

Plant a bulb outside in the fall and watch it grow into a plant by spring.

SIMPLE MACHINES

The material in this unit correlates particularly well with numbers and art work.

The following books are helpful:

Moving Day	Rand McNally	$.25
Who Built The Highway	Scribner	$2.75
Simple Machines And How They Work	Random House	

OUR EARTH

Since trained geologists often hesitate to identify positively rock specimens without making detailed tests, teachers should not feel that they must identify every rock brought into class. Describing rocks by their relative weight, hardness, color, etc., is often much preferable at this level.

PLANTS

There are two major groups of living things - plants and animals. Plants and animals are living things and are interdependent. They can be found in almost every environment.

The major objectives of this study are to foster general interest in plants as living things and to promote awareness of the great variety of plants. The child's interest will increase with careful observation and teacher guidance.

CONCEPTS

Plants grow. (3-6)
Plants change as they grow. (6-7)
Plants need food, water and sunlight. (3-7-9)
Practically speaking, plants do not move about. (12)
PLANTS ARE LIVING THINGS.

Some plants are raised from seeds. (7-18)
Some plants are raised from bulbs. (8-18)
Some plants are raised from other parts of plants; e.g., stems, roots, leaves, slips or cuttings (18)
PLANTS CAN BE STARTED IN MANY WAYS.

Plants vary in size. (2-3-4-13-14)
There are wild plants. (16-17)
There are garden plants. (17)
People and other animals eat some plants. (15)
Some plants are grown for beauty. (8-15)
THERE ARE MANY KINDS OF PLANTS

Plants live near us. (16-17-18)
Plants live in very wet places. (10)
Plants live in very dry places. (5-11)
PLANTS LIVE IN MANY PLACES.

People and other animals need plants to live. (15-19)
Some plants need care. (3-18)
LIVING THINGS NEED EACH OTHER.

MATERIALS

Fardener's catalogue
Seeds
Bulbs
Sweet potato
Ceranium slip
Sand
Blotting paper
Saucer
Flower pots
Carrot
Onion
Desert plants
A variety of plants
Aquarium (see Animal Unit)
Bean or pea pods
African violet leaf
Lima beans

TEXTBOOKS

1 - 1 : 70-81; 92-95
1 - 2 : 6-7; 15; 17; 102-103; 108-109
2 - 1 : 69; 71; 103-116
2 - 2 : 33-36; 182-194
3 - 1 : 53-56; 58-66; 68-69
3 - 2 : 61-71; 73-75
3 - 3 : 54-61; 68-69

ACTIVITIES

1. Motivation: Have the children look about them in the classroom, in their homes and community (playground) for examples of living plants. These living plants could be brought to school and a discussion of these plants held in class.

2. By the use of pictures of plants, demonstrate the difference in size. Example: flowering dogwood and giant sequoia.

3. Take the class to visit greenhouse, nursery, botanical garden, florist, orchard, playground or the home of a person in the community interested in growing different kinds and sizes of plants. Also look to see how plants are cared for and to see how new plants are started.

4. Any gardener's catalogue may be consulted for the lists of the many varieties of plants of any single species.

5. Make a small desert indoor garden in the classroom.

6. Moisten blotting paper, put it on a saucer, and place the seed on it. Cover with another piece of blotting paper and keep continually moist. Note if the seed germinates.

7. The children could grow plants from seeds. These seeds have been tried and grow quickly: parsley, lettuce, pumpkin and marigold.

8. The children could grow plants from bulbs. These bulbs have been tried and grow quickly: narcissus, hyacinth, onion and tulip.

9. Experiment to show that plants need food, water and sunlight to grow. Use two plants that the children have grown from seeds or bulbs. Put one in the sunlight and put the other one in a dark place. Water each plant every other day with the same amount of water. Every three days bring the two plants together to compare them. Have the children draw a conclusion.

10. Observe plants that are growing in the aquarium. Eelgrass, water milfoil, pondweed, water cress and certain kinds of algae can be collected from their habitat and placed in the tank to grow under similar conditions.

11. If children have a garden at home, perhaps they have had experiences with some plants that do not need as much water as others. This could be done in the classroom with different plants such as a cactus and a rubber plant.

12. Look for places on the playground or in the community, and through daily observation and discussion note such things as an extra-large tree or an unusually shaped bush, that has remained in the same place day after day.

13. Suggest that children look everywhere they go after leaving school for two plants that are very much alike (two leaves, two flowers, etc.)

14. The children could examine peas or beans in a pod or grains in an ear of corn, noting the difference in size, shape and color.

15. The children with the help of the teacher could make a list or a picture book of plants that they eat. The children with the help of the teacher could make a list or a picture book of plants we use for enjoyment.

16. Field excursion to playground or nearby park to observe wild flowers. Help the children to realize the need for protecting these plants as well as those in their gardens.

17. Make a bulletin board display of pictures of wild flowers and garden flowers.

18. Have the children raise plants from seeds, bulbs, roots, stems, leaves, slips or cuttings. This can be done by planting limabeans, onions, transplanting a small plant, carrot top, sweet potato, African violet leaf, and a slip from a geranium. The geranium should be started in wet sand until it roots; then transplanted to soil. Water it a little each day. An African violet leaf should be started in damp sand.

19. Have the children make a list of plants that their pets eat. This activity can be extended to farm and zoo animals.

RESOURCES

1. Morris Arboretum, 9414 Meadowbrook Ave., Phila. 18, Pa. Contact: Miss Mary Meszoly, Secretary. Call: Chestnut Hill 7-5232. Early booking ensures a guide. Specify date, time, rain date, size of group, ages and special interests of the group.

2. Bartram's Gardens, 54th & Elmwood Ave., Phila., Pa. Call: SA 9-5281. Contact: Mr. Baehr, Superintendent.

3. Wagner Free Institute of Science, 17th Street and Montgomery Ave., Phila. 21, Pa. Call: ST 4-6529. Contact: Mr. Chambers, Director. Contact one week in advance.

4. Garden Club (nearest school - contact: civic organization)

RESOURCE PEOPLE

1. Florist 2. Botanist 3. Gardener 4. Farmer 5. Nursery Owner 6. Forrester

FILMSTRIPS

1. Finding Out How Plants Grow (SVE)
2. Wild Flowers Everyone Should Know (SVE)

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Suggestion for Sources of Free and Inexpensive Materials: Fowlkes, John G. and others "Elementary Teachers Guide to Free Curriculum Materials". Randolph, Wisconsin, Educators Progress Service, 1959.

THE UNIVERSE - Things That Do Not Live

The environment is composed of two kinds of things - those which live (refer to unit "Plants and animals") and those which do not live (refer to unit "Our Earth"). Non-living things do not grow. They do not need food, water or sunlight. There is a great variation in non-living things.

CONCEPTS

Some things live. (Recall previous units on animals and plants.) (1)
Some things do not live; e.g., soil, rocks, water and air. (1-3-4)
Some non-living things resemble living things. (2-3)
THERE ARE THINGS THAT LIVE AND THINGS THAT DO NOT LIVE.

MATERIALS

Toys
Illustrations or pictures

TEXTBOOKS

2 - 1 : 150-151
2 - 3 : 39-56
3 - 2 : 62-63

ACTIVITIES

1. Motivation: Ask the child to tell which things in the classroom are not living. The furnishings of the class room may be classified in terms of living and non-living things. Games using the labels Alive, Not Alive, Animals, and Plants may be played. The children should be sure to label plants not only with Plants but also with Alive and animals in the room should also receive two labels. An activity such as this helps the children perceive that there are two major divisions: Living and Non-Living.

2. Discuss by the use of pictures or toys brought in by the child things that resemble living things but do not live; e.g., a toy dog, toy cat, dolls,etc.

3. As a culminating activity make a chart or display on a table living and non-living things. Pictures may be used in place of the things when compiling a chart. Or a variation may be for each child to make his own record using original drawings of living and non-living things.

4. Make up riddles about non-living things.

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Parker, Bertha Morris, Living Things. Row,Peterson, 1941

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LOWER MERION SCHOOL DISTRICT GRADE 1

THE LIFE OF THE EARTH - LIVING THINGS

It is important to provide opportunity for children to observe at first hand as much as possible and to perform experiments that will help them understand the science principles that deal with living things. There are many opportunities for field trips, for observations by individuals and small groups, and for group activities that involve planning and working together. This information gained through all these activities must be organized and related into important generalizations. In accordance with our objectives, we are interested not so much in teaching isolated facts about birds, bees, and butterflies as in developing important understandings useful in interpreting the environment. We are very much interested in helping pupils learn to enjoy the out-of-doors and develop a desire to explore it. The conservation phase of this study is of utmost importance.

ANIMALS

There are two major groups of living things - plants and animals. The purpose of the study of animal life is to help the child to develop the understanding that living things are interdependent and interrelated and that people are a part of this major group.

Our objectives are to create an interest in animals as living things, to observe accurately the living things, to become aware of the great variety of living things, to build a sense of relationship of living things to each other and their environment.

CONCEPTS

Generally speaking, animals grow. (1-7-8-10-11)
Animals need food to grow. (2-10-11)
Generally speaking, animals move about. (2-3-9-11)
People are animals. (11)
ANIMALS ARE LIVING THINGS.

Animals vary in size. (4-9)
Some animals are pets. (1-9-10)
Some animals can not be pets. (4)
Birds, fish, insects and human beings are animals. (9)
THERE ARE MANY KINDS OF ANIMALS.

Animals live in the woods. (3-6)
Animals live in water and near water. (3-6)
Animals live in the ground. (6)
Some animals make homes. (5-6)
ANIMALS LIVE IN MANY PLACES.

Some young animals need care. (2-8-10)
Some young animals do not need care. (2)
Human beings need parental care in early life. (8)
People need to care for some animals. (2-10)
ANIMALS HAVE NEEDS THAT MUST BE CARED FOR.

1. Blough, p.250

MATERIALS

1. Cages for pets brought to school
2. Oblong tank aquarium - clean sand, pebbles, natural objects found in streams, plant life (see plant unit), small net, rubber tubing for siphon
3. Animal picture collection (see Encyclopedia Britanica)

TEXTBOOKS

1 - 1 : 10-23; 88-91
1 - 2 : 134; 136; 137
2 - 1 : 43-52; 117-134
2 - 2 : 164-165; 168-179
3 - 1 : 3-24
3 - 2 : 3-6; 8-28; 62-63

ACTIVITIES

1. This unit on living animals could be introduced by the teacher reading an animal story, or the class could discuss their pets and bring in many pictures of familiar animals.

2. An animal such as a turtle, a tadpole, a goldfish, etc., could be kept on the science table in the classroom (stressing care of the animal and its growth). An aquarium could be made.

3. Arrange or draw pictures to illustrate how different animals move about (animal locomotion) to illustrate such sentences as:
   a. These animals fly. b. These animals swim. c. These animals walk.

4. The class could make a field trip to a farm, a zoo or a fish market to observe the many kinds of animals found there and the variation in size. When the class returns, the children could note the variation in size of their own classmates and the many different physical features.

5. The class could visit a playground or nearby area such as a wooded area near the playground, a park section or a creek. The children could look for animal life found in these areas.

6. Classify animal pictures as to whether they are land or water animals. (a variation of this would be for the class to draw two murals. Make one a land mural showing animals living on, above and below the surface, and the other a water mural. Have each child draw an animal and place it on the proper mural.)

7. Make a picture film strip that shows animals in the stages of growing up (dogs, birds, cats, ducks, chickens and human beings).

8. Use a picture collection to determine which of the animals are mature or are babies.

9. The teacher may wish to discuss a local dog show. If you are in an area where many children have pets, you may wish to have a pet show some time during the unit.

10. A child may bring in a baby pet (duck, chicken or dog). The class would discuss the size of the animal in relationship to a familiar object in

the room. The child who brought in the pet could report on the growth of the pet at a later time in the year. Some ideas about measurement of human beings could be introduced at this time. Use this activity to train pupils in scientific methods, i.e. observing, keeping records, reporting.

11. Keep comparative charts showing: a. Various animals growing
b. Various animals eating c. Various animals moving about.
Be sure to include human beings in each group.

RESOURCES

1. Academy of Natural Science, 19th & Parkway, Phila. 3, Pa.
Call - James A. Fowler RI 6-7622 - (optimum size 35, maximum size 50, admission charge 20¢ per person, museum guide 25¢ Tour takes 1 hour.

2. Norristown Zoo, Harding Blvd., Norristown, Pa. (picnic area available) or The Philadelphia Fairmount Park Zoo, Philadelphia, Pa.

3. Farm - Philadelphia High School of Agriculture and Horticulture, Henry Avenue south of Shawmont, Phila., 28, Pa. Call Bertram L. Lutton, Principal, Ivy-Ridge 3-2200 (call in advance)

4. Animal Hospital (nearest to school)

5. Pet Shop (nearest to school)

RESOURCE PEOPLE

1. Zoo Personnel
2. Farmer
3. Veterinarian

FILMS

1. Care of the Young - Radnor
2. Winter on the Farm "
3. Spring on the Farm "
4. Birds in Winter "
5. Flipped the Seal "
6. The Beaver "
7. Animals of the Woods - Radnor
8. Animals growing up - Encyclopedia Brit.
9. Adventures of B. Rabbit " "
10. Care of Pets " "
11. Farm Animals " "

FILMSTRIPS

1. Birds and Animal Babies (SVE)
2. Farm Animals and Pets "
3. Animals of the Zoo "
4. The World of Living Things "
5. Finding Out How Animal Babies Grow (SVE)
6. Finding Out How You Grow (SVE)

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McClung, Robert M. Stripe: The Story of A Chipmunk. Wm. Morrow, 1951
Morgan, Alfred, Pet Book for Boys and Girls. Scribner's, 1949
Witty, Paul and Others, Gray Squirrel. D. C. Heath, 1950
Zim, Herbert S., Goldfish, Wm. Morrow, 1947

OUR EARTH

A unit on Our Earth was selected to clarify the concepts of non-living objects. The child should be encouraged to observe things carefully and draw simple conclusions from his observation. This should lead the child to a better understanding of his environment.

CONCEPTS

Soil is a covering for most of the land surface. (1-2-8)
Soil has been formed from rock. (7)
Soil can differ in color. (3-4-8)
Soil can differ in size of particles. (4-5)
Soil is needed to grow things. (6-8-10)
THERE ARE MANY KINDS OF SOIL.

Some rocks are big and some are small. (1-9)
Some rocks are soft and some are hard. (7-9)
Some rocks feel smooth and some feel rough. (7-8-9)
THERE ARE MANY KINDS OF ROCKS.

Wind can blow away soil. (13)
Water can wash away soil. (11-12)
WIND AND WATER CAN MOVE SOILS.

Grass can help to hold soil. (11-14)
Rocks can help to hold soil. (11)
GRASS AND ROCKS HOLD SOIL.

Land (soil and rocks) is a part of our earth. (15)
Water is a part of our earth. (15)
Air belongs to our earth. (16)
OUR EARTH IS MADE UP OF MANY NON-LIVING THINGS.

Use concepts and activities from Living Things.
Use concepts and activities from Non-Living Things.
OUR EARTH IS MADE UP OF LIVING AND NON-LIVING THINGS.

MATERIALS

- Various pictures
- Soil (sand, rock, loam, etc.)
- Jars
- Small bottles
- Magnifying glass
- Plants
- Soft rocks
  - decayed leaves
  - stems or roots
  - dead insects
- Seeds
- Basin
- Grass plants
- Glove
- World Map

TEXTBOOKS

1 - 1 : 42-49; 56-59; 60-69; 82-87
1 - 2 : 24-25; 40-43
1 - 3 : 86-87; 110-114
2 - 3 : 2-22
3 - 3 : 37-52; 54-55

ACTIVITIES

1. Start a bulletin-board display of "places We Like to Visit" or "Places We Have Visited." Pupils may bring photographs of various scenic spots in their community or in their travels—mountains, lakes, deserts, etc. These scenes should be appropriately labeled, and attention should be focused upon the physical characteristics of the land.

2. Children could draw their visual impression of the covering of the land and what is below the earth's surface (cross-section).

3. Bring in soil from different places. Put cupfuls of the soils into jars of water. Let the jars stand until the water is almost clear. Observe the color and content. The rock material will sink to the bottom, and the plant material will float to the top.

4. Children should bring in samples of soil in small bottles. Samples should be obtained from a variety of places: playground, garden, bank of stream, gravel bed and the beach.

5. Examine soils under a magnifying glass. Label the soils according to places in which they were found. Notice the variations in the soils: such as,- color, the way it feels, the moisture and the living things in them.

6. Take two similar plants and transplant both plants, one to soil and the other to a pot containing small stones. Water both plants and have the children observe the results.

7. Teacher directed experiment: Children may observe after having rubbed two soft rocks together that small particles will break off from the larger rocks. This experience will be further explained by the teacher as to the other component parts that make up the soil.
   Use this sand-like material to form the base for a mixture. Try to find some decayed leaves, stems or roots, dead insects like crickets, grasshoppers and the like. Break these up and add them to the rock material. It is not possible to make real soil without the action of natural forces over a long period of time.

8. A walk around the school grounds or nearby park should provide observations on which to base discussions. Some things that might be observed are the color of the soil where plants are growing, the color of the soil where no plants are growing, the presence or absence of sand, gravel, or larger rocks, the thickness of soil if there are places where this can be observed.

9. The children can make labels: Small, Large, Soft, Hard, Rough, Smooth. Have the children bring in stones or small rocks and place them with the proper label.

10. Plant seeds in good soil. Break up rocks, and in this rock material plant seeds. Observe the results.

11. If there is a sidewalk or roadway close to the side of a hill, a trip to this place after a heavy rainfall will reveal that some of the soil and other material have been carried from the hillside and left on the sidewalk or road. Observe also small gullies in the land after a heavy rainfall. Conversely notice the soil with rocks or grass that has not been washed away.

12. Spread soil on a slanting board. Put a basin at the lower end. Sprinkle water at the higher end. Note what part of the soil washes down into the basin. (This could also be used with a sand table in the classroom.)

13. On the playground observe soil blown by the wind. An accumulation of soil may be found in protected corners. (Wind erosion)

14. Have the children examine grass plants. Observe the number of plants and the amount of soil clinging to the roots. The children may single out one plant and shake off the soil to study the root system. If a magnifying glass is available, it will aid in examining the plant.

15. Study globes and world maps noting the land and water surfaces. As a variation have them draw a circle to represent the earth. Color part brown for land and part blue for water.

16. By discussion and questions find out what kind of ideas children have about air. Guide the discussion so that the child will realize that we breathe air, air is all around us, it is held to the earth (by gravity) and it belongs to our earth.

RESOURCES

1. Norristown Water Company, Barbadoes Street at River, Norristown, Pa. Call: BR 5-1375. Tour and lecture.

RESOURCE PEOPLE

1. 4-H Club leaders for information about young people of the state and what they do to promote conservation
2. Residents in community employed as Geologist, Research Chemist, etc.

FILMSTRIPS

1. Finding Out About Land, Air and Water (SVE)
2. What Is the Earth Made Of? (McGraw-Hill Science Filmstrips)

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Podendorf, Illa, The True Book of Pebbles and Shells. Childrens Press, 1954
Schloat, G. Warren, Jr., The Magic of Water. Scribner's, 1955
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SIMPLE MACHINES

In teaching about simple machines, we should follow objectives at the elementary level that help the children see the great variety of machines and help them observe machines at work in their environment. The experiences should be simple. As often as possible use simple machines found at school or at home. The major concepts we have considered for this age level are that the wheel, the inclined plane and the lever are simple machines and that they make work easier.

CONCEPTS

Machines work for us. (1-3)
Machines help us to do work easily and rapidly. (1-2-3)
We use less force when we use a machine to help us do work. (1-3)
A MACHINE IS A THING THAT HELPS IN DOING WORK.

Objects with the quality of roundness will roll. (1-6)
Wheels are used in work and play. (2-4-7-8-9-10)
Some wheels are small. (2)
Some wheels are large. (2)
Wheels help us to do work more easily. (2-5-6-9)
WHEELS ARE MACHINES.

Some wheels are moved by people. (2)
Some wheels are moved by steam. (15)
Some wheels are moved by electricity. (2)
WHEELS ARE MOVED IN DIFFERENT WAYS.

Ramps make it easy to go up and down. (11-12)
Ramps make it easy to move things up and down. (11-12)
Ramps are inclined planes. (11)
Inclined planes help us to do work more easily. (11-13)
INCLINED PLANES ARE MACHINES.

Levers help us life heavy objects. (17)
Levers help us to do work more easily. (14-17)
LEVERS ARE MACHINES.

Some things rust. (19-20-21-22)
Machines can rust. (19-20)
Toys can rust. (19-20-23)
Things that rust need care. (22-23)
MACHINES THAT ARE CARED FOR WORK MORE EASILY.

MATERIALS

Hammer
Small wagon
Straight crowbar
Ruler
Large box
Dowl sticks
Labels

Tooth picks
Long plank
Pencil
Tongue depressors
Stones
Match sticks
Glass jars
Sand
Paper clips
Tacks

Any wheeled toy; e.g., wagon
Kindergarten blocks
A wooden box nailed shut
Round objects: ball, saucer
Wheels
New, unrusted nails
Machine oil
Rusty tools
Pennies
Dimes

TEXTBOOKS

1 - 1: c32-37
1 - 2 : 118-131
2 - 1: 1-10; 74-76
2 - 2 : 15-28

2 - 3 : 243-263
3 - 1 : 25-38
3 - 2 : 30-40
3 - 3 : 74-93; 50-51

ACTIVITIES

1. Ask the school custodian to show machines used to clean the school. He could also show the children the tools he uses to make repairs in the school.

2. Visit a local business such as a newspaper, a shoe repair shop, etc., to see how machines complete work in a shorter time.

3. The class could make posters about tools: "Tools the Carpenter Uses," "Tools for Making a Garden," "Tools I used in Building a Birdhouse," etc.

4. Have the children name things on which wheels are found (bicycles, skates, trucks, cars, etc.) Tell a story stressing the importance of wheels in relation to completing work with little effort.

5. Provide the class with a small wagon and a heavy object. Let the children take turns dramatizing an original story to show how the wagon could tansport a heavy load more easily.

6. Some of the children may be able to make a chart on which each object has a different number of wheels; for example, a wheelbarrow (one wheel), a bicycle (two wheels), a tricycle (three wheels), and a doll carriage or a wagon (four wheels). Each object should be labeled with the number of wheels it has.

7. Discuss the relationship between the size or weight of a vehicle and the number of wheels it has. Lead the children to observe that a large, heavy object, such as a train or a trailer truck, has many wheels.

8. Make a survey in the classroom, school, home, garden or food store of ways in which wheels help in doing work.

9. As an experience a child could fill a box with stones and drag it across the floor. Discuss the difficulty the child had pulling the heavy load. Then Tinker Toy wheels could be added. Further discuss the importance of wheels in daily living.

10. The children will probably want to prepare an exhibit of pictures of wheeled objects for their own classroom. Further classification may be developed by charts, such as wheels for fun, wheels for work, wheels on the farm and wheels at home.

11. The children could construct an overpass with inclined approaches on both sides. They can run their machines up the overpass and down again, using the two ramps in their imitative play. Use this as an opportunity to lead the children to tell where they have seen this kind of overpass in their community and to discuss how people have been helped by it.

12. Children could draw pictures to express their ideas about the use of inclines (moving vans, loading trucks, etc.)

13. Children could demonstrate how a ramp can help us to move things more easily on a stairway in school. Have the children pull a wheeled toy (wagon, coach, etc.) up the stairway and note how difficult it is. Then place a large plank on the stairway and note how much easier it is now.

14. Planned experience: Have brought to class a box that is nailed shut. Then the children could suggest various ways to open the box. If the use of the lever is not suggested by the children, the teacher should show how much easier and quicker it would be to use this simple machine.

15. Make use of the opportunity to observe the steam-operated train in the Franklin Institute when you take a trip to the Planetarium.

16. Any number of games can be devised to stress the relationship of roundness to rolling and to distinguish between types of roundness. Children may be blindfolded and handed various objects such as balls, blocks, dishes, books, etc. Children try to guess the names of the objects and tell whether they will roll.

17. Fun with a lever: Children could make a simple seesaw with the use of pencils, rulers, match sticks, tongue depressors, tooth picks, and dowl sticks.

18. This could be used as a culminating activity. Draw a mural depicting the every day use of the three simple machines (wheel, inclined plane and lever).
    a. Indoor scene: Kitchen with kitchen utensils, workshop with tools, etc.
    b. Outdoor scene: Constructing a new highway, constructing a new building, gardener at work, etc.

19. Have rusty objects on display. It could be used to start a discussion of rust and how it can be prevented. Rusting machinery or large rusted objects seen on a field trip may also be used to start the discussion.

20. Experiment to show that things with iron in them will rust under certain conditions. Have the children fill one jar with wet sand. Label it "wet sand." Fill the other jar with dry sand. Label it "dry sand." Place two nails in each jar. Look at the nails each day. Check to see which nails have rusted and why.

21. Have the children fill a jar with wet sand. Put some pennies, dimes, nails, paper clips, etc., into the sand. Look at them each day to find out which things rusted. Or fill three glasses with water. Place pennies in one glass, nails or tacks in another and marbles in the third one. Several days later look at these glasses to see which objects have rusted.

22. Have the children fill a jar with wet sand. Label the jar "wet sand." Put two nails in the wet sand. Fill another jar with wet sand. Label this jar "wet sand with oiled nails." Rub some oil on two nails. Put them in the second jar of wet sand. Look at the nails after several days. Discuss with the children why the oiled nails did not rust.

23. Through discussion relate these activities to the care of tools, toys, bicycles, etc. A list of ways to care for machines can also be made.

RESOURCE PEOPLE

1. School Custodian 2. Gardener 3. Carpenter 4. Builder

FILMS

1. How Machines and Tools Help us, Coronet (11 minutes)
2. Simple Machines, Encyclopedia Britannica Films, (10 minutes)

FILMSTRIPS

1. Machines - Tools That Help Us Work, SVE, #EA 425-4
2. How Wheels Help Us, Filmstrip House, 347 Madison Ave., New York 17, N.Y.
3. How Ramps Help Us, " " " " " " "
4. How Levers Help Us, " " " " " " "

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10. Now Try This. Wm. Scott, 1947
11. What Makes Wheels Go Round. Reynal and Hitchcock, 1940

LOWER MERION SCHOOL DISTRICT GRADE 1

HEALTH HABITS

This unit for grade one stresses the importance of developing good health habits and attitudes. The intent of this is to show to the child the important role he plays in keeping himself healthy and to develop consciously the habits he must perform throughout his life.

CONCEPTS

Our teeth, skin, hair, eyes, and ears are important tools for daily living. (1*, 3, 4, 5*, 6, 8*, 11*, 12*, 14*)
Our teeth, skin, hair, eyes, and ears must be kept clean. (2, 7, 9*, 10*, 13, 15)
WE MUST TAKE CARE OF OUR TEETH, HAIR, SKIN, EYES, AND EARS TO BE HEALTHY.

Nurses, dentists, and doctors help us keep our health. (4, 13, 15, 16)
Regular medical examinations often keep us from getting ill. (17)
THERE ARE PEOPLE WE CAN TURN TO FOR HELP IN KEEPING HEALTHY.

We must wear the proper clothing for the season of the year. (18*, 20)
We must wear clean clothing. (19)
CLEAN CLOTHES ARE NECESSARY FOR GOOD HEALTH.

Good posture is important in standing, sitting, walking, and running. (21)
Good posture helps the different parts of the body to do their work better. (22)
GOOD POSTURE IMPROVES OUR GENERAL HEALTH.

*These numbers refer to items under Activities and Data that provide facts for the teaching of the concept.

ACTIVITIES AND DATA

1.* Our teeth are tools for cutting, grinding, and chewing food to prepare it for digestion. They are the only "bones" that we can see. Our teeth are covered by the hardest material in the entire human body--enamel. This covering enables the teeth to take great shocks without any harm. Teeth that are damaged by decay, however, cannot repair themselves; then we must go see the dentist.

Human beings have two sets of teeth--a set that grows in early childhood and a much larger set that grows in and pushes out the first set. The first set numbers twenty, called milk teeth; the second set has thirty-two teeth, called permanent teeth. These teeth will be permanent only if they are permanently cared for. The sixth year molars are the first permanent teeth.

The cutting is done by the sharp edged front teeth and the grinding by the back teeth with their broad, even tops.

2. Too keep our teeth from decay, we must brush them daily. We should brush them after meals. Eating too much sugar in candy will cause our teeth to decay. Have the children demonstrate the proper way to brush teeth after rules for brushing teeth have been formulated. Some possible rules are: (1) brush down over the upper teeth, (2) brush up over the lower teeth, (3) brush your teeth on the inside and outside, (4) brush the tops of your back teeth, (5) rinse your mouth by forcing water between the teeth, (6) keep your brush clean.

3. Draw pictures and make a composite chart of the foods that help make good teeth. The chart would include milk, leafy vegetables, eggs, peas, and beans.

4. The dentist is our friend and should be visited in between checkups if there is any toothache. A child who enjoys going to the dentist could tell about his experiences there. The children might be told that relatively painless drills are being developed.

5.* The skin helps to protect the delicate parts beneath it from injury. The skin keeps out germs and dirt as long as it remains unbroken. Nerves in the skin tell us things about touch, temperature, and pain. The children could close their eyes to see if something feels rough or smooth, hot or cold, wet or dry, soft or hard. How does the desk feel? the board eraser? the blackboard? radiator?

6. The skin helps our bodies keep cool when we get heated. Wet one hand by dipping it into water. When you hold your hands in the air, the wet hand feels cooler. Things get cooler when water evaporates from them; this is one way in which our bodies are cooled.

The body, too, gives off water through tiny openings or pores in the skin. When the perspiration evaporates, cooling takes place. Why do the children think we perspire on a hot day? The perspiration helps us to keep cooler. (The perspiration contains some body wastes, too.) How can we replace the water the body is always losing?

7. Discuss why the skin is thicker on the palms of the hand and the soles of the feet. This happens because of their constant use. What must we do if we get a cut in the skin? What should we do if we get a cut in our skin that will not stop bleeding? Why should we put medicine on a small cut and a band aid over it? Why is a clean skin necessary for health and for appearance? How can a dirty skin cause us trouble if we get a cut?

   Here is an interesting riddle. What part of the body grows faster than any other part and never stops growing, even though it never gets any bigger once it has reached its full size?

8.* The hair (and the nails) are parts of the skin which grow in certain ways to give special protection to the parts they cover. The hair grows out from the roots under the skin. The hair gives the top of our heads special protection against blows and the extremes of heat and cold. The hair should be kept clean, neat, and well trimmed; this has much to do with our appearance.

9.* The comb and hairbrush help to keep our hair looking neat. Combing the hair helps to keep it in place and brushing the hair removes dust, dirt, and dead particles of the scalp from the hair. Brushing stimulate and improves our scalp.

10.* Discuss why we should wash the hair at least once a week and oftener if we have engaged in active sports. Why should we use a clean brush and comb and wash them often to keep them clean? Keeping our hair clean helps to keep vermin, or lice, out of the hair.

11.* We must take care of our eyes because they must be used for a lifetime. The eye secretes a fluid during the night which hardens about the eye; this must be cleaned away when the face is washed in the morning. The eyelids, eyelashes, and eyebrows are natural protectors for the eyes. The eyelids open and close over the eye like a curtain. The eyelashes are tiny hairs along the edges of the eyelids and help keep dust out of our eyes. The eyebrows are hairs which help to keep perspiration out of our eyes.

12.* Tears are a fluid by which the outside of our eyes are bathed. The tears keep the eyeball moist so that the lids can easily move over it and the tears also wash out germs and dust.

   If something gets into the eye, we must not rub it. We must try to let the tears wash it out. If the irritation of the eye keeps up, we must go to the school nurse.

13. Discuss what we must do if our eyes hurt and we cannot see properly. How can the eye doctor help us if our eyes hurt? How are some people aided in seeing better: Glasses are aids for many people to see better.

   How can we get sore eyes by putting our fingers into them? Why shouldn't we ever use someone else's towel? Our fingers are covered with germs and towels get covered with germs when they have been used.

14.* The ears are the tools by which we are aware of the sounds of the world around us. We can only see a small part of the wonderful organ that enables us to hear. We can hear because sound waves travel through the air in all directions, just as waves spread out in all directions when an object is dropped into water.

Discuss pleasant sounds the children hoar in their daily living. Discuss unpleasant sounds. Have them listen carefully on the way to school one morning and discuss all the sounds that they heard. Did they hear loud sounds, soft sounds? Did anyone hear a growling sound, a chirping sound, a hissing sound, or a sizzling sound? What do they think made the sound?

15. We must keep our ears clean because dirt and wax collect in our ear canal. What is the proper way to remove the dirt and wax? We remove dirt and most wax in our ears by cleaning our ears with a washcloth. If too much wax accumulates, it should be removed by the pupils' doctor.

Discuss how the doctor or school nurse checked the pupils' hearing at the last physical examination.

Find pictures of the interior of our ear and have the children see what a wonderful organ the ear really is.

Discuss these safety rules for the ear. Why don't we ever shout into someone's ear? Why don't we ever hit anyone on the ear? The shouting and the pressure of the blow can damage the ear drum.

How can pulling ears be dangerous? This can cause ear injury. Thomas A. Edison was deafened by having his ears pulled. He was attempting to climb into a freight car with both arms full of newspapers. A conductor took him by the ears to lift him into the car. Edison felt something snap in his head, and his deafness began then.

16. If our ears hurt us, we should tell the teacher, school nurse, or parent about it. Why should we see a doctor quickly if our ears hurt us? An earache tells us that something is wrong with our ears. If not attended to, earaches can lead to serious illness and even deafness.

What do people do who have lost part of their hearing? Hearing aids help them hear sounds that would otherwise be lost to them.

Why must we blow our nose gently? The Eustachian tube connects the middle ear with the throat; blowing too hard may force germs through the tube into the middle ear and cause infection.

17. Discuss how sharp pointed objects, such as knives, scissors, nails, pens, pencils, and sticks, can hurt us? Discuss how we go about handing sharp pointed objects to others.

Why is it wise to see a doctor for checkups once a year even if we do not feel ill? The doctor is our friend and can often see possible troubles even before we do by examining us. Why does the school give us regular examinations? How can the way we feel affect the way we learn?

18.* We wear clothing to cover and protect the body and to keep our skin from getting injured. There are different kinds of clothing--we have clothing for play, clothing for work, and fine clothes for parties and visiting. Clothing should be loose and comfortable. Tight clothes around our chest interferes with our breathing. Tight clothes around our arms, legs, and waist can interfere with the circulation of our blood. (We might mention that shoes are clothing for the feet; shoes that are too tight can cause the bones of our feet to grow improperly.)

What kinds of clothing do we wear to school? for play? to a party?

How does our skin tell us that we are cold? We get goose pimples and start to shiver.

19. We must wear clean clothing because soiled clothes are germ collectors. Clothing next to the skin gets soiled from perspiration, particles of dead skin, oils from beneath the skin, and gets an unpleasant odor. Clean clothing adds to our appearance.

Discuss the fine feeling we get when we put on clean clothing or when we go to sleep between clean sheets. A dirty body will soil clean clothes; dirty clothes will soil a clean body. We need both a clean body and clean clothes.

20. We wear different kinds of clothing in the various seasons. There are winter clothes, summer clothes, swimming clothes, snow suits, sun suits. All of these clothes have a special purpose. This health unit can be integrated at this point with the one on animals.

Animals and birds have covering (clothes) for protection. Bears, beavers, foxes, and squirrels have heavy furs and thick skins; birds have feathers; fish have thick, scaly skins; oysters, clams, and turtles wear shells; trees have bark; seeds have outside coats.

The children like to learn how man has used for his own purposes the raw materials that nature has cultivated, such as wool, leather, and furs. Much of the clothing we wear has come from plants and animals, such as cotton and silk.

We wear different kinds of clothing in different seasons of the year. Winter clothing prevents the heat of the body from being lost too rapidly. Wool in winter clothes does not let heat pass through it easily; cotton in summer clothes does allow the body to get rid of heat.

Perhaps the children will bring up the concept that the homes we live in are affected by the climate we live in, etc. Children might like to discuss how Eskimoes live in the north and how natives near the equator dress and the reasons for this.

The children can answer these rhymes as a class or individually.

"What shall we wear
When it's wet and gray
On a rainy day?

When it's blue and dry
In the summer sky?

When cold winds blow
Across the snow?"

21. We walk, stand, and sit straight to help our backbone grow straight. Good health is a chain of linked habits; for example, poor posture may be due to weak muscles, weak muscles may be caused by improper foods. Poor posture may force the bones out of their proper positions and good posture helps the bones grow into their proper positions.

22. Besides aiding our appearance, good posture helps the different parts of the body to do their work better and improves our general health. The chest is held up and the shoulders are held back in good standing and sitting postures; this is done naturally and not stiffly. A person breathes more easily and can better supply the body with the oxygen it needs with good posture.

Good posture helps keep the organs of the body from being crowded and helps the organs of our body to do their work better. A slouched position may interfere with the proper action of the heart and lungs and put an unnecessary strain on them.

FILMS

Animals in Winter 43
Autumn on the Farm 64
Birds in Winter 115
Care of Hair and Nails 208
Care of the Skin 210
Cotton 250
Doctor 331
Eskimo Children 392
Lazy Lucy 806
Posture Habits 1111
Teeth are to Keep 1383
Ways to Good Habits 1509
Wool 1537

FILMSTRIPS

Getting Ready for Winter F445-4	Society For Visual Education
The Story of Cotton 204-1	" " " "
The Story of Wool 204-2	" " " "
Let's Stand Tall 567-4	" " " "
Let's Visit the Dentist 567-5	" " " "

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ELEMENTARY SCIENCE REVISION - 1962

EVALUATING THE UNITS

SECOND GRADE

Gerald Craig wrote, "As the child matures, he profits from past experience and utilizes old learnings in interpreting new situations. More complex concepts emerge under the expert guidance of the teacher. ... Thus we see simple learning elements added one to another to form new concepts, which in turn are added to other concepts. In this way the maturing child grows toward an understanding of the basic principles of science which explain a wide range of the phenomena of living and non-living things." [1]

In first grade our children were introduced to Living Things, Non-Living Things, and Energy. In this grade, these beginnings are built upon. "Seasons - Plants and Animals" adds to his lore of Living Things; "Weather" and "Earth, Sun, Moon, and Stars" extend his vision of Non-Living Things; "Sound"begins to deepen his concept of Energy.

The evaluation sheets for the second grade units were uniformily enthusiastic. So much so that any appraisal of them that did not simply clearly mirror this fact would be misleading. For this reason no changes were made in the second grade units.

A few teachers noted that they felt the planets should be included in the study of the "Earth, Sun, Moon and Stars". A full scale unit on the solar system is assigned to fourth grade, where it was felt the older child would be better able to handle the concepts involved. It is doubtless true that under the guidance of an interested and able teacher a beginning of the study of the planets can be profitably made at this time.

Additional suggestions that were made concerning the different units appear on the bottom of this sheet.

The new health unit "Food and Nutrition" is also included.

Additional Suggestions for Teaching the Units

SEASONS - PLANTS AND ANIMALS

Have the children make up poems about the change of the seasons.

SOUND

Tie the handle of a fork in the middle of a four-foot length of string. Hold the ends of the string against your ears and let the fork swing against a table. (Sound travels better through a solid then it does through the air.)

WEATHER

Construct four dioramas of a house and a tree. Add weather scenes. (Fair, rain, fog, snow.)

EARTH, SUN, STARS, MOON

A piece of clay serves the purpose as well as a doll for activity 14 and is simpler.

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[1] Science For Today's Children. Ginn, 1958. Pg. 16

Grade 2

SEASONS

To a child of this age the round of seasons brings a sense of mystery and fun. He will notice that plants and animals adapt without thought or planning to the season shift; but that he as a human being must work and adjust to the ever-changing cycle. Thus man's intelligence bears special responsibilities in keeping with his tremendous advantages.

CONCEPTS

Weather changes in summer. (3-4-49-52)
Plants adapt to summer conditions. (5-6-7-59)
Animals adapt to summer conditions. (8-9-10-11)
People have ways to adjust to summer conditions. (12-13-14)
SUMMER IS A SEASON OF CHANGE.

Weather changes in autumn. (15-16-17-18-19)
In autumn plants make changes. (20-21-22-23-24-25-26-27-28-29-59)
In autumn animals make changes. (8-10-11-30-31)
In autumn people plan for changes. (13-14-32-33-34)
AUTUMN IS A SEASON OF CHANGE.

Weather changes in winter. (35-36-37-38-)
Plants adapt to winter conditions. (20-39-40-41-59)
Animals adapt to winter conditions. (8-9-10-11-42-43-44-45-46-47)
People have ways to adjust to winter conditions. (13-14-48)
WINTER IS A SEASON OF CHANGE.

Weather changes in spring. (49-50-51-52-53-54)
In spring plants make many changes. (20-27-55-56-57-58-59-60-61-62)
In spring animals make many changes. (8-10-11-63-64-65-66)
In spring people prepare for changes. (13-14-67)
SPRING IS A SEASON OF CHANGE.

MATERIALS

Seeds
Magnifying glass
Clay
Flower pots
String
Bulbs
Evergreen (old Christmas tree)

TESTBOOKS

1 - 1 : 10-14; 42-43; 50-55; 70-74
1 - 2 : 4-5; 12-23; 25; 32-38; 60-73; 76-77; 90-105
1 - 3 ; 47; 94-97; 152
1 - 4 ; 5-6; 11-17; 21-43
2 - 1 ; 11-25; 43-51; 58; 63-73; 106-114; 135-144
2 - 2 ; 29-40; 81-83; 89-93; 101-120; 131-145; 164-165
2 - 3 ; 111-112; 211-215
2 - 4 ; 230-231
3 - 1 ; 19; 39-52; 59; 62; 68
3 - 2 ; 41-60; 68-69
3 - 3 ; 32-36; 36-37; 54-55
3 - 4 ; 105-109

ACTIVITIES

1. Motivation: Introduce a game to help the children remember the order of the seasons. Choose four children to represent the four seasons, and have each child wear a sign telling what season he represents. Ask "Spring" to stand, and have the other three seasons arrange themselves in proper order behind him. Repeat the game several times, with different seasons at the head of the line.

2. Motivation: Take four large sheets of paper and label each one with the name of a season. Let the children collect or draw pictures illustrating a garden in each of the four seasons and mount them on the sheets.

3. Keep a record of the temperature starting with the first day of school until the change of season. Choose the hottest day and coldest day from the record. Keep a permanent record of these days.

4. Keep a weather chart. Record the day by day changes of sky and wind.

5. Discuss the variety of plants in summer. Make a list of the flowers children report having been grown in their own gardens.

6. Start a written record of plants using the following titles:

   Changes We See in Trees
   Summer Autumn Winter Spring
   Changes We See in the Garden
   Summer Autumn Winter Spring

7. Take pictures of certain plants on the playground in summer. If a camera is not available, have the children draw these pictures. Save some of them for comparison in later seasons. Trees would be good to use for this activity.

8. Take a walk near the school to see animals that can be found in summer. Help the children record and organize their observations; e.g.

   Animals in Summer
   On the play ground - ants, grasshoppers
   In the yard - rabbit, ants, cutworms
   On the way to school - squirrel, robin, etc.
   This activity could be repeated for the other seasons.

9. Draw pictures of animals found in the local environment showing how they look in summer and in winter.

10. Trip to the zoo can be taken during any season.

11. Keep a diary about one animal. Through observations the children will be able to record how the animal adapts itself to the weather conditions of each season. Moths, butterflies, praying mantis, frogs are some animals that could be used for this activity.

12. Have the children make a list of activities typical of summer weather. These could be general or classified; e.g., children's activities, mother's activities, father's activities, etc.

13. Picture charts and murals can be made showing the clothing worn and the activities carried on in summer. This activity could be repeated for each season.

14. Keep a record of the heigth of each child.

15. Continue to record the weather conditions of wind and sky. (Refer to Activity 4.) Foggy days may be added to the chart. This activity could be continued in winter and spring, adding snowy days, etc.

16. Have the children bring in the weather forcast found in newspapers.

17. Keep a record of the temperature of each day in autumn. At the end of autumn choose the record of the hottest and coldest day. Add these to the permanent record. (Refer to Activity 3.) This activity could be continued in winter and spring.

18. Discuss the change of the number of sunlight hours in a day in autumn. Compare them to those of the first week of school.

19. Field trip to playground to look for signs of autumn.

20. In autumn draw or take a picture of the same plant as in Activity 7. Compare and discuss change. Repeat this activity in winter and spring.

21. Encourage the children to bring in collections of leaves, seeds, and other signs of autumn. Charts or individual booklets could be made. Stressing the great variety of seeds and leaves is as important at this level as identification.

22. Make a leaf collection of fall leaves. Identify the leaves.

23. Collect pictures of flowers and their seeds. A variation: have the children draw a picture of the plant and how its seed looks in autumn; e.g. milkweed, dandelion.

24. Make a collection of seeds and seed pods.

25. Keep a chart of seeds classifying them as to the ways they are dispersed.

26. Plant seeds in different pots. In one pot place all the seeds together. In the other pot plant the seeds several inches apart. Note the difference in growth. Help the children keep a written record of their observations and conclusions. Note how important natural phenomena are to seed dispersal.

27. Plant some bulbs. These will also be used in a spring activity. Exa mine the bulbs closely before planting. Cut an onion to show where food is stored. Note the stem in the middle. Keep in mind these concepts: plants store food for future use; some plants store food in their leaves; other plants store food in bulbs.

28. Grow some bulbs without soil. Note that food for plant growth comes from the bulb.

29. Use a magnifying glass to examine leaf buds in autumn. Note any changes made since last season.

30. Discuss the migrating of birds. Stress the fact that birds gather in flocks and leave in flocks. Their flights southward are often long, they go to places with milder weather and easier food sources.

31. Make a list of animals that live in the community. Watch these animals in autumn noting which ones leave the neighborhood as cold days come, which animals stay active, which animals will hibernate.

32. Have the children make a collection of foods that are harvested in autumn.

33. Help the children prepare a Harvest Fair. Exhibit seeds, leaves, murals of autumn scenes, ways mothers or children have preserved foods for winter.

34. Paint a mural to show how fathers and mothers get ready for winter.

35. Have the children note all the signs of coming winter that they see as they play outdoors and coming and going to and from school, or the things they observe while on rides or walks with their parents.

36. Have the children make a play thermometer from paper. Use a red piece of paper to show the same reading on the play thermometer as on the real thermometer.

37. Through the use of radio weather reports, a record of the temperature can be added to the weather chart.

38. Paint pictures to show cold winter days, how animals make changes in winter, how plants make changes in winter.

39. After leaves have fallen from trees, you can easily see the tiny buds on the branches. They were formed during the summer as the tree stored food. Watch these buds during the winter months. Watch for changes when warm days arrive.

40. Observe the evergreens in winter. Note they do not lose their needles at any particular time.

41. Dig up a small plot of grass. Be sure to get the roots too. Note that the leaves are dead. Care for it in the classroom. Observe that the roots live through the winter.

42. If possible, keep turtles, tadpoles, or salamanders in the classroom during the winter. Note that they are less active after a cold week end.

43. Display on the bulletin board pictures of animals such as squirrels, chipmunks, bears, insects, birds, etc. Have children discuss what these animals do to survive during the winter months.

44. Make a list, use pictures, or draw the birds that stay with us in the winter. Show the foods that they eat in winter.

45. Observe animal tracks in the snow.

46. Observe bird tracks made in the snow.

47. Use the Christmas tree as a bird feeder.

48. Read to the children and discuss with them the poem, "In Winter I Get Up at Night," by Robert Louis Stevenson.

49. Take as many walks outdoors as possible at different times to watch changes of weather throughout the seasons. Keep going back to the same place and try to recall changes from the previous trip. Keeping a record of such walks adds accuracy to this activity. This activity could be repeated each season.

50. Broaden the concept of change which the children may have by helping them record some of the everyday changes they see, hear, smell, and touch. Have them watch for the unusual as well as the common place. This might be kept for a week,

51. Keep a record of the time the sun rises and the sun sets each day. Keep this record for several weeks in the spring. Note the increasing number of sunlight hours.

52. Trace and cut out the shadow made by a child. Record the child's name, date, and time. Repeat this activity each season at the same time of the day. In spring compare the shadow pictures.

53. Make a shadow stick. Put it in the sun and measure the shadow at a definite time. Keep a record of the length of the shadow at the same hour each day. Compare.

54. Discuss clearly remembered Autumn, Winter, and Spring holidays such as Thanksgiving, Christmas, and Easter. Have the children mention whether it was dark or light when they woke up in the morning, whether it was a cold day or a warm day. Emphasize the differences between the Autumn, Winter, and Spring holidays.

55. Refer to Activity 27. Examine the bulbs closely after they have finished blooming. Show how bulbs can be stored.

56. Plan to watch buds of several trees in spring. Tie a string around one low branch of each of several kinds of trees. Note the change. Draw pictures frequently to show the changes.

57. Gather twigs from various trees or shrubs in early spring. Examine the leaf buds with a magnifying glass. Place the stems in water and observe the buds with a magnifying glass on successive days.

58. Observe the evergreens in spring. Note the new green growth at the ends of some branches.

59. Take pictures of the same plant at different times throughout the year. In the spring these pictures can be displayed on the bulletin board as a plant calendar. If a camera is not available, have the children draw the same plant each season.

60. Plant seeds in the classroom, stressing proper care for growth.

61. Visit a farm in spring.

62. The children could change the words of the familiar song "The Farmer in the Dell":

1. The farmer sows the seeds
The farmer sows the seeds
Heigh-ho! the derry-o!
The farmer sows the seeds

2. He plants them in the ground
He plants them in the ground
Heigh-ho! the derry-o!
He plants them in the ground

3. The sun begins to shine
The sun begins to shine
Heigh-ho! the derry-o!
The sun begins to shine

4. The rain begins to fall
The rain begins to fall
Heigh-ho! the derry-o!
The rain begins to fall

5. The plants begin to grow
Heigh-ho! the derry-o!
The plants begin to grow
The plants begin to grow

This could be dramatized by one or many children.

63. Keep a bird chart in spring. List three things on the chart: "Name of bird," "When seen," "Where seen.'

64. Make a bird wheel. Divide a cardboard circle into fourths. Label each section with the name of a season. Mount bird pictures in each section appropriate to the season.

65. Make a calendar or keep a diary of events; e.g.,

Birds We See Around Us

Date of Arrival	Name of Bird	Where We See Birds

Changes We See in the Spring

Date	Changes We See

66. Make bird eggs out of clay. Paint them true to nature.

67. Let the children tell about the work their fathers and mothers do. Pay particular attention to people whose work changes with the seasons, such as farmers, construction workers, recreation workers, those who make and sell ice cream and soft drinks.

68. Divide the class into four groups, and have each one do a mural of his school yard during one of the seasons.

69. Culminating activity: This activity could be used several times throughout the year. At one time the things made could represent plants, holidays or special days.

Have twelve children represent each of the twelve months. Each child should make something to wear or carry that is characteristic of that month.

Twelve other children, each holding the name of a month, should give the proper name of the month to the child that is representing that month.

Draw a circle on the floor and divide it into sections. Label each section with the name of a season. The remaining children of the class could have an opportunity to group the children, representing the twelve months, into the four seasons by placing them in the section that represents their season.

The children that represent March, June, September, and December should stand with one foot on either side of the line that divides the sections of the circle.

RESOURCES

1. Local florist shop
2. National Audubon Society, 1130 Fifth Avenue, New York 28, N. Y. (for pictures, bulletins, and other helpful material)
3. A farm to observe farm animals at different seasons and to learn about the relation between farm crops and the seasons
4. University Museum, 34 and Spruce Streets, Phila., Pa. Call: EV 6-1241. Contact: Secretary of Educational Department. Maximum size group -40. Consists of tour through museum.
5. Philadelphia Zoological Garden, 34 Street and Girard Avenue, Phila.,4, Pa.

RESOURCE PEOPLE

1. Vetenarian
2. Florist
3. Local bird enthusiasts or Audubon Club Member
4. Game Warden

FILMS

Pond Life	Radnor	Film	Library
Spring on the Farm	"	"	"
Summer on the Farm	"	"	"
Two Little Raccoons	"	"	"
Birds of the Door Yard	"	"	"
Autumn on the Farm	"	"	"
Animals in the Winter	"	"	"
Beaver	"	"	"
Birds in Winter	"	"	"
Gray Squirrel	"	"	"
Insect Zoo	"	"	"

Winter on the Farm - Encyclopedia Britannica Films
Autumn Is An Adventure - Coronet Films

FILMSTRIPS

Through the Seasons Series (color) Young America Films, 18 E. 41 St., New York 17, N. Y.

Autumn Is Here	SVE
Winter Is Here	SVE
Spring Is Here	SVE
Summer Is Here	SVE
A Trip to the Autumn Woods	SVE
Plants and Animals in the Spring	SVE
Winter in the Country	SVE
Summer on the Farm	SVE

Summer Comes to the Country - Stanley Bowmar(CNFB) Co., 12 Cleveland St., Valhalla, New York

Winter Comes to the Country - Stanley Bowmar (CNFB) Co., 12 Cleveland St., Valhalla, New York

Animals in the Four Seasons - Eye Gate House Inc., 2716 41 Avenue, Long Island City, 1, New York

Nature in the Four Seasons - Eye Gate House Inc., 2716 41 Avenue, Long Island City, 1, New York

Work in the Four Seasons - Eye Gate House Inc., 2716 41 Avenue, Long Island City, 1, New York

Trees and Flowers in the Four Seasons - Eye Gate House, Inc., 2716 41 Avenue, Long Island City, 1, New York

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LOWER MERION SCHOOL DISTRICT GRADE 2

SOUND

The purpose of this unit is to create an interest in sound by the use of "things to do" and to tell the beginning story of sounds -- how they are made, how they differ, how they travel and how they may be controlled.

CONCEPTS

You make sounds. (1-11-15)
You hear sounds. (1-2-10-12-18)
SOUNDS COME TO OUR EARS.

Some sounds are soft. (3-11-12-15)
Some sounds are loud. (3-11-12-15)
Some sounds are high. (3-11-12-15)
Some sounds are low. (3-11-12-15)
Some sounds are pleasant. (3-11-12)
Some sounds are noises and are unpleasant. (3)
THERE ARE DIFFERENT KINDS OF SOUNDS.

Sounds come from moving things. (5-13-14-22-26)
You hear sounds when things move back and forth rapidly, i.e.,quivering, trembling, shaking back and forth (5-6-7-13-14-22-26)
When things move back and forth, they vibrate. (5-18-13-14-22-26)
SOUND IS A VIBRATION.

Sounds travel through air. (16-23)
Sounds travel through water. (9-14)
Sounds travel through solids. (4-21)
Sounds travel through air, water and solids in all directions. (16-17)
SOUNDS TRAVEL THROUGH MANY THINGS.

Sound bouncing from a far away object is an echo. (27)
SOUNDS CAN BOUNCE AGAINST OBJECTS.

Sounds tell us how near or far away something is. (19-20-23)
SOUNDS TAKE TIME TO TRAVEL.

Some sounds warn us of danger. (24)
Some sounds tell us of time. (24)
Some sounds tell us of work. (24)
Some sounds tell us of play. (24)
Some sounds are used for enjoyment (11-12-24)
SOME SOUNDS ARE USEFUL.

Many factories could be less noisy. (25)
Many communities could be less noisy. (27)
There are some things that people can do to have less noise in the community. (25)
LESS NOISE WOULD MAKE OUR COMMUNITIES MORE PLEASANT TO LIVE IN.

MATERIALS

Comb
Nails
Bowls
Chalk
Watch
Stones
Hammer
Wax paper
Paper bag
Rubber band

Megaphone
Drum - cymbal
Rulers or pencils
Pictures
Long narrow board
Record player

Large size tuning fork
Rubber sheets or other materials
Flower pots
Glasses varying in sizes
Large container for water
Empty cheese box or oatmeal box
Rhythm band instruments
String
Buttons

TEXTBOOKS

1 - 2 : 78-89)
(Rand McNally) 2nd : 75-77
(Rand McNally) 3rd : 134-146
(Rand McNally) 4th : 185-196 (excellent illustrations for advanced readers)

ACTIVITIES

1. Motivation: The teacher asks the children what sounds they make when they are happy, sad talking to a playmate in the classroom, calling to a playmate on the playground, whistling for their dog, etc. A discussion of other sounds made by animals, musical instruments and other things found in their environment could follow.

2. The children could listen for sounds in the classroom, playground or cafeteria. Make a list of the things that make the sounds.

3. Find pictures which show that some kinds of sounds are being made; for example, drums in a parage, football game, etc.

4. A child could place his ear against one end of a table. Have another child tap the other end of the table. Then ask the child if he heard someone who tapped at the other end of the table. A discussion could follow.

5. Have a child press his lips against a comb covered with wax paper. Then have the child hum a tune. Ask if the child can feel anything. Discussion of vibration could follow. Or a child could press a blade of green grass between his two thumbs. Then the child puts his lips to the grass and blows. Ask the child if he felt anything.

6. Ask the children to find out how the sounds are made by different musical instruments. Pictures could be used (plucking, blowing, striking, etc.)

7. A child could blow up a paper bag. Then he could squeeze the top together in one hand and strike hard against the bag with the other hand. The child could conclude what makes the sound.

8. A child could stretch a rubber band over two nails hammered into a board. Then the child could pull at the band. The child could draw on the blackboard what he saw.

9. Have a child tap two stones together in a pail of water. Ask the child if he heard the sound. The teacher may suggest that when the children are at a swimming pool they could put their heads under water while someone clicks two stones together lightly.

10. Plan a trip for observation of sound: to hear the school band or orchestra give a program, in the neighborhood to hear sounds of the country or city or to a park to hear sounds of nature. Have the children recall and draw pictures of these experiences immediately upon their return to school.

11. Make a recording of the musical activities of the class: singing, humming, whistling, or playing musical instruments. Play back the recording for recognition of sounds and their quality.

12. The children could visit a music shop where they can see and hear demonstrations of musical instruments. (Violin, cello, trumpet, harp, drum, etc.) Observe that sounds are made by blowing, quivering, trembling, shaking back and forth, etc.)

13. The children could make drums by stretching a piece of rubber sheet or other material over a bowl or cheese box. This then can vibrate the drumhead to make sounds. Put some tiny pieces of ground chalk or some powder on the drumhead; watch what happens when the drumhead is vibrated.

14. A way to show that vibration is related to sound is to have a child strike a tuning fork and dip the vibrating ends into a container of water. The children will see the water splash out of the container, although they may not see the ends of the fork vibrating.

15. The children could make flowerpot chimes using flower pots of graduated sizes. They could hang the pots upside down by the use of twine attached to buttons large enough not to slip through the hole in the bottom of the flowerpot. The pots may be hung from a broomstick extended from one chair back to another. A small hammer or any other object may be used to tap the flowerpots to make sounds. A variation of this would be to use several glasses filled with different amounts of water. This will show that there are different sounds.

16. The children could use a megaphone on the playground to see how effectively sound may be directed. Let one child walk several yards away from the class and shout to the class with and without the use of the megaphone. Children may make small megaphones from paper.

17. This is a demonstration that will show that sound travels in all directions. A child could stand in the middle of the room. Four children could be chosen to stand in the four corners of the room. Have the child in the center make a sound. Ask if the other four children heard the sound.

18. Have the children make charts or lists of some of the animals that make sounds. The charts could be divided into topics such as some sing, some croak, some hammer against trees, and some make sounds by rubbing their legs and wings together. Children could draw pictures or collect pictures of some animals that make sounds.

19. The teacher could discuss the sound a jet plane makes when flying overhead. The children would conclude that the jet plane made the sounds, but were out of sight before the sounds reached them. Some jet planes travel faster than sound. The sound seems to follow them.

20. A recent storm or picture of a storm could develop a discussion of the sounds heard. The teacher could explain that you always see the flash of lightning before you hear the crash of thunder during a storm. It is necessary to stress that a time elapses between the moment you see the lightning and you hear the thunder.

21. This is an experience that can be had in the classroom. Have each child listen to the ticking sound of a watch. After each child has done this, the watch could be secured at one end of a wooden board. Each child could then take a turn to place his ear at the opposite end of the board to listen for the ticking of the watch and should conclude that sounds travel through wood.

22. Each child in the class may be urged to bring some sound-maker and demonstrate it to the class to see whether the pupils can decide what vibrates to make the sound. To add interest to the demonstrations, it may be suggested that pupils try to exercise originality in their selection. They may bring toys, musical instruments, use their own voices, etc.

23. When children are trying to show that they can see the action before the sound, they can demonstrate this fact on the playground. Let a child carry a large drum or something else that will make a loud sound a block or so away from the rest of the class. Let him strike the drum with a broad gesture that can be seen at a distance. Pupils will soon observe that they do not hear the sound until the drummer's arm is ready to strike the drum again.

24. Have the children bring in pictures to illustrate "How Sounds Can Be Useful": the clanging of the fire engine, the ringing of the school bell, the ringing of an alarm clock, etc.

25. Children could draw pictures to illustrate community and factory noises; e.g., excessive honking car horns, continuous loud barking of dogs, construction workers drilling streets, factories located near homes, noises within the factory (sound proofing).

26. This experiment can be done by one child to demonstrate things that vibrate. This child extends his ruler or pencil over the edge of the desk. Hold the ruler firmly with one hand and strike it with the other.

27. The class could be taken to a large empty room (such as the gym or auditorium). Then have a child shout and the other children could listen for the echo (resounding voice). As a contrast the class could visit these rooms when another class is in session. Or a large empty barrel could be brought to the classroom. Then a child could shout into the barrel and the class could listen for the echo.

28. Culminating activity: Make a chart using the topics: Sounds I Like to Hear and Sounds I Do Not Like To Hear, or Sounds That Are Near and Sounds That Are Far Away.

RESOURCES

1. Harmonic Society of Germantown, 1111 Lancaster Ave., Rosemont, Pa. Call LA 5-4184. Contact Mr. Sherwood, General Sales Manager. Guide provided for free tour to see musical toys and harmonicas manufactured. (Visits are more desirable during the fall term.)

2. Lester Piano Manufacturing Co. Inc., Fourth Street, Lester 13, Pa. Call Tinicum 3-9050. Contact Mr. P. F. Wentzel. Tours scheduled only on Tuesday, 10:30 A.M. to 12 noon. Guide service is provided; tour takes 1½ hrs.

RESOURCE PEOPLE

1. Music Teacher 2. Speech Teacher 3. Musician

FILMSTRIPS

1. Light, Heat and Sound (SVE)

FILMS

1. What is Sound? Coronet Films (11 minutes)
2. Sounds All About Us Coronet Films (11 minutes)

RECORDS

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Brown, Margaret W., The Winter Noisy Book. Harper, 1947

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Kettlekamp, Larry, The Magic of Sound. William Morrow, 1958

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Polendorf, Illa, True Book of Science Experiments. Childrens Press, 1954

" " The True Book of Sounds We Hear. " ", 1955

Grade 2

WEATHER

This weather unit is an introductory phase of the three weather makers - air, heat and water. At this level our major objective is to present concepts that will be applicable to and understandable in the child's everyday experiences.

CONCEPTS

Air is all around us. (1-2)
Wind is moving air. (3-4-5-6-7-8-9-10-11)
A north wind is often cool. (3-10-11)
A south wind is often warm. (3-10-11)
AIR MOVES.

Dust is in the air. (12-13)
Smoke is in the air. (14-15-16)
There is water in the air. (17)
THERE ARE MANY THINGS IN THE AIR.

Water goes into the air. (18-19-20-21)
Heat helps water go into the air. (22-23)
Sometimes there is more water than the air can hold. (24-25)
Water comes out of the air as rain. (25)
Some of the water comes out of the air when the air is cooled.(25-26-
Water travels up and down from ground to cloud and back again.(27-28)
WATER GOES INTO THE AIR AND COMES OUT AGAIN.

Clouds are in the air. (29)
Clouds are high in the air. (30-31)
Clouds are low in the air. (30-31)
Clouds change their shapes. (29*32)
On cloudy days the clouds form between the sun and earth.(33-34)
Clouds are made up of small drops of water. (33)
Rain comes from the big dark clouds. (29-35)
Fog is a cloud at ground level. (36-37)
CLOUDS HELP TO MAKE WEATHER CHANGES.

Water freezes when the weather is cold. (38)
Water freezing in the cloud falls as snow. (39)
Snow that forms on the ground is frost. (40-41)
COLD MAKES WATER FREEZE.

The sun's heat melts frost. (42)
The sun's heat melts snow. (43)
The sun's heat melts ice. (44)
HEAT MAKES FROZEN THINGS MELT.

Days can be cold, warm or hot. (45-46-47-48)
Days can be sunny, rainy, cloudy, foggy or snowy. (49-50-51)
WEATHER CHANGES FROM DAY TO DAY

Grade 2

MATERIALS

- Soda straws
- Feather
- Stapler
- Small glass tube
- Coffee can
- Pan
- Flashlight
- Red ink
- Large hat box
- Terrarium
- Pins
- Long stick
- Four paper cups
- Incense
- Dish
- Electric light
- Large jar
- Clay
- Streamers
- Compass
- Paper plate
- Nail
- Two containers
- Kettle
- Wax paper
- Ice cubes
- Magnifying glass
- Ice cube tray

TEXTBOOKS

1 - 1 : 42-55
1 - 2 : 24-39; 60-62; 122-123
1 - 3 : 86-97
2 - 1 : 11-25; 58-63; 145-149
2 - 2 : 113-122; 131-148
2 - 3 : 110-113
3 - 1 : 39-47; 52
3 - 2 : 41 -60

ACTIVITIES

1. Motivation: Discuss the fact that air is all around. Plants in the classroom need air to grow. People need air to live. (We breathe ai Encourage the children to name places where they think air is found. Bring out the fact that air is over the city, over the trees, houses, high above the ground as well as down in the ground.

2. Use a large hat box. In one end of the box cut a half-inch hole. Squeeze the sides of the box. Have the children feel the air coming through the hole. The air coming through the hole in the box will blow paper streamers or feathers.

3. Make a wind vane. Push a pin through a soda straw. Put a feather in one end of the straw. Hold the straw in a horizontal position and put a pin through the center of the straw and into the eraser end of a pencil. Tie it to a long stick and with the use of a compass wind directions can be found.

4. Take the children on a field trip to observe all the things they can that shows that the wind moves.

5. Make a fan and fan yourself.

6. Use a square piece of paper. Cut diagonally from each corner to almost the center. Put a pin into every other corner and then through the center of the square. Push a pin into the eraser end of a pencil.

7. Open a book and close it quickly. Feel the wind on your face.

8. Put a crumpled piece of paper in front of a book. Open the book and close it quickly.

9. Observe on the playground moving clouds, swaying branches, clothing of pepple, direction of smoke, etc.

10. The speed of wind may be measured by an anemometer. Let the children make a simple wind instrument. Take a paper plate. Be sure to mark the center accurately. Staple four paper cups horizontally on the rim of the plate. Push a pin through the center mark on the plate, and force it into the eraser on a pencil. (A nail may be used instead of a pin. Hammer it into a stick of wood.) The wind is caught in the cups and forces the plate to turn. The speed with which it turns is an indication of the force of the wind.

11. A wind vane can also be made by hammering a long nail through a thin piece of wood. Use a small glass tube that has an open end and a closed end. Place the tube over the nail. Be sure it turns freely. Fasten to the tube a soda straw that has a feather in one of the open ends. Mark N,S,E,W on the board. By the use of a compass hold the wind vane in proper position. Allow it to swing freely in the wind.

12. The children could observe dust in a stream of sunlight.

13. Have the children observe the dust blowing in the air on a windy day.

14. Encourage the children to look at chimneys on their way to school.

15. Burn incense. Watch smoke rise.

16. Discuss the smoke problem that many cities have.

17. Fill a jar with colored water. Put into the jar several ice cubes. Let it stand for a few minutes. Observe what has happened to the outside of the jar. Let the children feel the outside.

18. Discuss the evaporation of puddles after a storm.

19. Put the same amount of water in two containers. Put a lid on one of the containers. Observe them for several days.

20. Put equal amounts of water in several dishes of different shapes. Observe for several days. More water disappears from some containers than from others because of the different amounts of exposed surface.

21. Place a coffee can out-of-doors during a heavy rain to observe how much water falls. Bring the can and water inside to see that the water will evaporate if left uncovered.

22. Put equal amounts of water in containers of the same size. Put one in a warm place. Place the second one in a cool, shady place.

23. Wash a dish in cold water and let it stand for a few minutes. Wash a dish in hot water and let it stand for a few minutes. Which dries faster?

24. Discuss the fact that when there is more water in the air than the air can hold it drops to the ground as rain. Observe the fluffy white

25. Make a cloud with a kettle. Then put cold water in a pan. Cold water makes the pan cold. Now hold the cold pan near the cloud from the kettle. This makes the cloud cold. When the drops in a cloud are cooled, they come together making big drops which are heavy and fall down.

26. Ask a child who wears glasses what happens to his glasses when he comes into a warm room after being out in the cold air.

27. Show by use of a terrarium how water comes out of the air, drops on the soil and plants. The water will go into the air again. It will be cooled at the top of the jar. Then drops will come out of the air again. (For further information concerning the terrarium, consult Blough or Craig.

28. Make a picture that shows how water goes up and down.

29. Study the clouds over a period of several days so that various types can be observed. It is not necessary to teach the pupils the names of typical cloud formations.

30. A weather chart could show a record of clouds, many or few, high or low.

31. Airplanes can be observed in relation to clouds.

32. Make pictures of cloud formations. Write appropriate titles for the pictures. E.q., "These clouds were in the sky Wednesday."

33. This experiment, is a very simple one. Exphasize caution by telling the children not to hold their hands too close as a bad burn might result. The class could make a little cloud. Put water in a kettle and heat it until you see a littke cloud. Hold something made of glass near the cloud, but not in it.

34. Use an electric light to represent the sun. Have the children cut out a cloud from wax paper. Show how the wax paper keeps the light from shining through. (A flashlight may be used instead of the light bulb.) Have them conclude that in the day time the sun is always shining even though sometimes it is hidden from view by clouds.

35. Read to the class some of Stevenson's poems such as, "The Rain Is Raining All Around," "Who Has Seen the Wind?"

36. Read, Carl Sandburg's "Fog" to the children as an introduction to the study of fog.

37. Children can see how fog is formed. Fill a large jar with hot water. Empty all except about one inch of the water. Place a tea strainer over the mouth of the jar. Fill it with ice cubes. Fog forms as the warm moist air comes in contact with the ice. It forms at the top of the jar first but gradually fills it.

38. Put a pan of water outside to freeze if the weather is cold. If it is not cold put a pan or jar of water in the refrigerator.

39. Catch several snowflakes on a dark paper. Examine them with a magnifying glass. Observe how very quickly they melt. Refer to Encyclopedia Britannica for snowflake designs.

40. If possible the children could examine the frost on the inside of the cafeteria or home refrigerator. The frost is composed of tiny snow crystals piled on top of one another.

41. Discuss that frost comes out of air that is freezing cold and covers outdoor objects on the earth; e.g., window panes, roof tops, ground, etc. Have the children relate their experiences with frost.

42. Place an ice cube tray that has frost on it in the sun for a few minutes. Observe the results. Also discuss frost as it appears, on sidewalks, trees, window panes, etc., in cold weather.

43. Observe on a snowy day that the snow has not melted in shady places but has melted in places exposed to sun.

44. Place several ice cubes in a pan. Put this container in the sun.

45. Make a thermometer. Fill a bottle with red ink. Put some clay around the straw. Push the straw into the bottle. Be sure the clay is tight. Put the bottle filled with ink in cold water. Then try it in warm water.

46. Record the temperature each day.

47. Listen to the radio weather report or watch it on television.

48. Bring in for bulletin board and notebooks pictures of people using thermometers; e.g., nurse, doctor, research chemist, etc. Relate to measurement work and problem solving in arithmetic.

49. Have the children collect pictures showing different kinds of weather.

50. Make pictures of different kinds of weather. Put people in the picture.

51. Keep a weather chart or clock to see that the weather changes often. (Refer to Blough, p.216.)

52. Culminating activity: Call on the children to tell of experiences they may have had with the wind. They may like to dramatize how they have to walk on a windy day.

53. Plan a trip to a weather station if there is one in the locality. Interview the weather observer about his work and the kind of observations he makes.

Grade 2

RESOURCES

1. United States Weather Bureau, International Airport, Philadelphia, Pa. Call: BE 2-4275 or WA 2-6662. Contact: H.P.Adams.

2. United States Naval Air Station, Willow Grove, Pa. Call OS 5-7070, Ext. 203. Contact: Command Liaison Office. Tour with lecture and displays, Wednesday through Saturday at 10:--, 1:30 and 3:00.

3. Local newspaper for weather maps and weather forecasts.

RESOURCE PEOPLE

1. Meteorologist
2. Local farmers, nurserymen, and fruit growers to learn how the weather bureau helps them and how they protect their crops in extreme or unusual weather.
3. Physics teacher

FILMS

Watercycle - Radnor Film Library
The Weather Station " " "
The Thermometer - Official Films, Inc. Gand and Linden Aves.
Ridgefield, N.J.
Clouds Above - Baily Films, Inc. 6509 DeLongpre Ave.,
Hollywood 28, Cal.
Blow, Wind, Blow - Coronet Films, Coronet Bldg. 65 E. South Water St.,
Chicago 1, Ill.
Weather - Young America Films, 18 E. 41st Street, New York, N.Y.
Nothing But Air - Instructional Films, Inc.

FILMSTRIPS

Weather - Young America Films, 18 E. 41st St., New York 17, N.Y.
The Thermometer " " "
We Learn About the Weather - Popular Science Pub. Co. AV Division,
353 Fourth Ave. N.Y. 10
How Does Water Get Into the Air? The Jam Handy Organization, 2821 E.
Grand Blvd. Detroit 11, Mich.
What Is an Experiment? " " " "
What Is Wind? " " " "
What Makes Things Dry Faster? " " " "
Where Do Clouds Come From? " " " "
Why Is the Night Cooler than the Days? " " "
Why Do We Have Rain? - The Filmstrip House, 25 Broad Street,
New York 4, N.Y.
Why Do We Have Wind? " " " "
Why Do We Have Warm and Cold Days " " "

Grade 2

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Tresselt, Alvin R., *Bonnie Bess, The Weathervane Horse.* Lothrop, 1949
Zolotow, Charlotte S., *The Storm Book.* Harper, 1952

Grade 2

EARTH, SUN, STARS, MOON

To these small ones, who can as yet count comparatively few moons in their lives, the difficulty of reaching out to touch the stars may pose a problem for the teacher. With so little of a tangible nature in the unit, the approach at this time is more in the nature of an overview leaving the real delving for the greater maturity of the fourth and sixth grades.

CONCEPTS

The earth is like a big ball. (3-4-5-6)
The earth is large in comparison to our community. (7-8)
The earth is much too big for us to see all at one time. (6-9-10)
THE EARTH IS ROUND AND VERY LARGE.

The earth is a moving ball. (11)
The earth is moving around the sun. (12)
The earth spins around like a top. (11-13)
As the earth spins, part of the earth always faces the sun. (14)
A part of the earth is always away from the sun. (14)
THE EARTH SPINS AS IT MOVES AROUND THE SUN.

Mountains, plains and valleys are a part of our earth. (15-16-17-18-
Lakes, streams, rivers and oceans are a part of our earth. (15-16-17-18-19)
Air and clouds are a part of our earth. (18-19)
LAND, WATER, AIR AND CLOUDS ARE A PART OF OUR EARTH.

The sun is larger than the earth and moon. (20-21-22)
The sun is very far away from the earth. (20-21-22-23-24-25-26)
THE SUN IS LARGE BUT LOOKS SMALL BECAUSE IT IS FAR AWAY.

The sun is so hot it gives off light. (27)
Sunlight is the brightest light we know. (28-37)
Some of the sun's heat and light reach the earth. (29-30)
The heat and light from the sun are necessary to life on the earth. (30-31)
THE SUN GIVES US HEAT AND LIGHT WHICH HELPS US TO LIVE.

Each morning the sun appears to rise in the east. (32-33)
Each day the sun seems to move across the sky. (32-33)
Each evening the sun appears to set in the west. (32-33)
The sun is shining somewhere at night. (11)
THE SUN SHINES ALL THE TIME.

Stars are immense globes of heated materials. (22-34)
Stars are the sun. (35)
There are many stars hotter than our sun. (34-36)
There are many stars cooler than our sun. (34-36)
Stars shine by their own light. (34-37)
Stars are in the sky during the day time (37)
OUR SUN IS A STAR.

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Stars vary in their distance from the earth. (36-38)
There are many stars much larger than our sun. (39)
There are many stars much smaller than our sun. (39)
STARS ARE DIFFERENT SIZES.

Stars seem to be arranged in groups. (40)
Stars grouped together are called constellations. (41)
Stars and constellations have names.(41-42)
THOUSANDS OF STARS CAN BE SEEN IN THE SKY AT NIGHT.

The moon is round like the earth. (22-43)
The moon has mountains like the earth. (44)
The moon gets light and heat from the sun as the earth does. (45)
THE MOON AND THE EARTH ARE ALIKE IN SOME WAYS.

The moon is smaller than the earth or sun. (22)
The moon is nearer the earth than any other object in the sky. (46)
THE MOON IS SMALL BUT LOOKS LARGE.

The light from the sun reaches the moon. (45-47)
The moon reflects some of the sun's light. (45-48)
Moonlight is never as warm or as bright as the sun. (49)
SUNLIGHT SHINING ON THE MOON MAKES MOONLIGHT.

The moon moves around the earth. (47-50)
Sometimes we see a whole round moon. (51-52)
Sometimes we see part of the moon. (52)
THE MOON LOOKS DIFFERENT EACH NIGHT.

MATERIALS

Globe
Clay (colored)
Paper Doll
Button
2 balls (large and small)
Pair of pliers
30 or more marbles
Mirror
Paper sailboat
Flashlight
String
Compass
Pieces of metal
Knitting needle
Sand
Pin
Small tube
Light bulb
Dime
Nickel
Small board
Small flashlights
Oatmeal box
Extension cord

TEXTBOOKS

1 - 1 : 50-55
1 - 2 : 40-63
1 - 3 : 98-123; 126-133
2 - 1 : 15-19
2 - 2 : 1-14
2 - 3 : 230-242
3 - 2 : 44-45
3 - 3 : 40-47

ACTIVITIES

1. Motivation: Display the globe a few days before introducing the unit about the earth.

2. Motivation: Encourage children to discuss places they or members of their families have visited. Discuss the length of time it would take to visit far off places. Find these places on the globe.

3. Use a globe for the earth. Cut a sailboat out of paper. Move the sailboat over the earth.

4. If possible, display pictures taken from rockets showing curvature of earth.

5. Put the tip of your finger on the globe. It covers only a little part of the globe. The globe feels flat. Put both hands on the globe. They cover a large part of the globe. The globe feels round.

6. Roll a piece of paper to make a small tube. Close one eye and look through the tube with the other eye. Hold the end of the tube an inch or two above the globe. Note a little part of the globe looks flat, but the whole globe looks round.

7. Discuss places children have visited developing distance and time relationships. By the use of the globe and a strip of paper measure the distance traveled. Use another strip of paper to measure the distance around the globe. Compare.

8. Put small pieces of clay on the globe to represent the community. Note the tiny part of the whole globe one community occupies.

9. Choose a familar place about ten miles from the school. If you drove there and back 400 times, it would be the same as straight through the center of the earth 8,000 miles. Going twice a day every day it would take more than a year. If you drove to this place and back 1,250 times you would drive as far as it is around the earth, 25,000 miles.

10. Have the children make sketches of what they see nearby and faraway on the outdoor trip to a hilltop or the top of a building.

11. Have a child turn around and around to show how the earth rotates. Add a sun to this demonstration by having another child turning while the earth child rotates and moves around the sun child.

12. Mark the outline of a sunny spot shining somewhere in the classroom. Repeat this in a half hour or so. Notice how the spot of sunlight has moved. Point out that it was the earth that moved, not the sun.

13. Use a bright light (flashlight or light bulb) to show the relationship between the moving (or rotating) earth and the succession of day and night.

14. Make a small paper doll and fasten to the globe. Using an electric light bulb to shine on the globe, rotate the globe counter clockwise to show that the sun will not always shine on the paper doll.

15. Find the land and water parts on the globe.

16. Make small clay models of the earth. Use different colors of clay to represent land and water.

17. Draw pictures to show some of the earth's surface features; e.g., mountains, plains, and valleys. They could also be made of papier-mache' or plasteline.

18. Discuss the things that belong to our earth. Draw a picture of the earth showing and labeling the parts that belong to our earth: air, clouds, land and water.

19. Have the children make pictures or clay models to show the earth's surface features such as mountains, valleys and plains.

20. Using a piece of string three feet long for the radius, draw a circle on the floor. Now put a dime on the floor beside the large circle. If the dime represents the earth the sun would be as large as the circle. (In order to have the correct visual impression of a solid round ball, clay could be added to the dime.)

21. Draw a circle out doors about one and a half yards in diameter to represent the sun. About thirteen and a half yards away from the sun circle place a button about half an inch in diameter. Note relationship both as to size and distance apart.

22. Circles cut from cardboard or circles drawn on the floor or playground will show the children relative sizes for comparison of sun, earth and moon. By adding clay to both sides of the two smaller cardboard circles we can show the relative size and roundness of the moon and earth.
At this age level the following scale is useable and as accurate as possible for the development of the concepts:

	Circumference	Diameter
Sun	228" (19 ft.)	72" (6 ft.)
Earth	2 1/6"	3/4"
Moon	1/2"	3/16"

23. Look at a house in the distance. Close one eye and hold a nickel in front of the other. Things close seem larger.

24. Have one child stand close to the class holding a small ball. Have another child stand far from the class holding a large ball. Note the size in relationship to the distance.

25. Look at a house, tree, or car in the distance. Close one eye and hold a nickel in front of the other. The object viewed will be covered by the nickel. Note that the nickel seems to be bigger than the larger object because it is closer to the eye. Relate this to the size of the sun.

26. Darken the room. Put an electric lamp on the floor to represent the sun. Eight feet away from the lamp stick a pin in the floor. The head of the pin represents the earth. Note: sun is far away; earth is small; light and heat of the sun goes in all directions.

27. Place a piece of metal in the direct sunlight.

28. Place a lighted bulb in the direct sunlight. Note there is no change.

29. Place various metal objects in the sunlight and in shade. Note which feel warm and which feel cool.

30. Darken the room. Use a lamp for the sun and a globe for the earth. Pretend the sun can be turned off like an electric light. Show that there would be all nights and no days.

31. In the school yard place a small board on the grass. Note the change when shaded from the sunlight. Uncover and again note the change.

32. Draw someone's shadow in the morning. Draw it again at noon and again in the afternoon. Compare the shadows.

33. Three trips to the playground on the same day will help to show the sun's position in the day sky: morning, noon, and afternoon. Record these by drawings.

34. Demonstration: With a pair of pliers hold a steel knitting needle or a piece of iron in a very hot flame. Note the change of color. First red light, red hot; yellow light, the metal is hotter; bluish-white light, very,very hot. Relate this to the stars.

35. Make two charts entitling one the "Sun" the other the "Stars." List similar facts about each title. Follow this with a discussion Noting the similarities. Lead the children to draw the conclusion that the sun is a star.

36. Make a film strip to show the estimated temperature of distant stars. Scientists have estimated distances of solar objects from the colors of those objects. Colors are red, orange, yellow, blue. (Refer to Heath, Grade 6, page 274).

37. Use several very small flashlights. Darken the room. The small flashlights represent the stars. Turn on a large light bulb, representing the sun. Note that fewer stars can be seen. Relate this to the brightness of sunlight.

38. You will need about thirty marbles. Take them outdoors and place them on the ground in a cluster. Arrange them so that no marble is less than an inch apart. Stand so that you are looking toward the marble. Slowly back away. As you back away you will notice that the marbles seem to be moving closer together.

39. On the playground have a small child stand close to the group and a tall child stand far away from the group. Note the difference in size. Relate this to the stars.

40. Make star constellations with marbles in the sand or on the ground.

41. Draw a picture of the Big Dipper on black paper. Tape the paper to the end of an oatmeal box from which the top and bottom have been removed. By using a pin, put holes in the star picture.

42. Read or tell some of the mythology connected with the better known constellations; e.g., the Big Dipper, the Little Dipper, Orion, etc.

43. By discussion and use of the calendar find out when there is a full moon. After observation have the children draw a picture.

44. Use pictures, films, or filmstrips to observe the moon: film, "This is the Moon"; filmstrip, "The Moon."

45. Use a globe for the earth, a light bulb for the sun, a mirror for the moon. Show by the position of these that the light of the sun can be reflected on the globe.

46. Have a discussion of space travel to the moon. The moon is so close to us in space that scientists expect to build a rocket ship that can reach it. (Refer to Heath, Book 6, Page 276.)

47. Follow the time of moon rise and moon set by use of the newspaper report.

48. By use of a mirror or other shiny object, show how light can be reflected to a wall, sidewalk, etc.

49. Place a metal object in direct sunlight. Place another metal object in reflected sunlight. Note the difference in warmth. A thermometer could be substituted for the metal object.

50. Repeat Activity 11. Have a third child represent the moon and move around the earth child. The moon child always faces the earth child while moving. All three children should be moving at the same time.

51. Use a light for the sun, a ball for the moon, and a child for the earth. The child will hold the ball so that one side is completely lit up. Turn the ball slowly to the left and then almost half way around to show how it appears to change shape because of the light it receives.

52. Make a moon book. Put in drawings of the moon as it appears each night at the same time. Do this for four weeks.

53. Have the children look for magazine and newspaper accounts of current astronomical discoveries. (Culminating activity)

54. Make a list of all the new words learned while we studied about the earth, sun, stars, moon. (Culminating activity)

55. Write a short story using information learned from the study of the earth.

56. Arrange for a trip to the planetarium. (Culminating activity)

57. Make riddles using the facts learned in each phase of this unit; e.g., I am very large. I am made of hot glowing gases. My heat and light go out in all directions. Without my light and heat, nothing could live on the earth. What am I? (Culminating activity)

58. Look at the night sky through binoculars to see the moon and stars. The next day they could draw or write about what they had seen. (Culminating activity)

59. Make collections of pictures showing many of the different kinds of nights. (Culminating activity)

60. Give oral reports about the sun, moon, and stars. (Culminating activity)

61. Suggest an imaginary trip to the moon. Have the children write rhymes, riddles and stories about this trip. Tell about the things you would need to take with you.

RESOURCES

1. Fels Planetarium, Franklin Institute Building, 20 and Parkway, Phila., Pa., Call: LO 4-3600 - Ext. 202. Admission 18¢. School show at 10:30 on Tuesday, Wednesday, Thursday and Friday, also at 2:00 Tuesday and Thursday. Make reservations in advance.

2. Luminous sky charts can be obtained from the National Equipment Service of the Girl Scouts.

RESOURCE PEOPLE

1. Local amateur astronomer
2. Military and naval personnel in the community for information about the use of the heavenly bodies in navigation
3. Boy and Girl Scout leaders

FILMS

What Makes Day and Night?	Radnor Film Library
Our Big, Round World	Coronet Films, Coronet Building, Chicago 1, Illinois
The Sun's Family	Young America Films, 18 East 41 St., New York 17, N.Y.
This Is the Moon	" " " " " " " " " " "
Sun, Earth, and Moon	Almanac Films, Inc., 516 Fifth Ave., New York 18, N.Y.

FILMSTRIPS

Our Home, The Earth	SVE
The Sky Above Our Earth	"
Finding Out About the Sky	"
The Earth	Encyclopedia Britannica Films
The Night Sky	" " "
The Moon	Young America Films
Day and Night	" " "
Stars in the Sky	Eye Gate House, Inc., 2716 41 Ave., Long Island City 1, N.Y.

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LOWER MERION SCHOOL DISTRICT GRADE 2

FOOD AND NUTRITION

This unit for grade two, Food and Nutrition, is important because it teaches the child about the four food groups necessary for a balanced diet. The child should learn that he can help keep and maintain good health throughout life with a proper intake of food. The object of this unit is to have the child practice in school and at home the proper eating habits that will attain this end.

CONCEPTS

We need food as fuel. (1*)
We need food as building materials for the human body. (2*)
We need food to replace worn out tissues. (2*)
WE NEED TO EAT THE RIGHT FOODS TO SUPPLY THE BODY'S NEEDS.

We need food from the milk group. (3-7-8*)
We need food from the meat and fish group. (4-7-8*)
We need food from the vegetable and fruit group. (5-7-8*)
We need food from the cereal group. (6-7-8*)
THE FOUR GROUPS OF FOOD ARE NEEDED FOR A GOOD DIET.

We must take time to eat food properly. (9*)
We must eat the proper snacks. (10)
WE MUST HAVE PROPER EATING HABITS.

*These numbers refer to items under ACTIVITIES AND DATA that provide facts for the teaching of the concept.

ACTIVITIES AND DATA

1.* Our bodies use the food we eat as building materials and as fuel. Our body is a wonderful machine, much more wonderful than your parents' automobile. Your father puts gasoline into his car for fuel to keep it running. If he puts in gasoline that is not right for the make of the car, the car will run but not as well as it would run if the right gasoline were used. If your father puts the wrong type of fuel in the car, the vital parts of the engine will complain by knocking. A knocking engine cannot do the job it was designed to do. If the knocking of the engine is not corrected, the engine will be damaged permanently.

If we continue to give the organs in our bodies inferior fuels (foods), they will be unable to perform their functions well and our general health will suffer as a result. Malnutrition can affect our health over a period of time.

On a trip, your father must put in gasoline to keep the automobile running as the car burns its fuel very rapidly. Our bodies burn its fuel very slowly. Food in the body is burned to release the heat or energy it contains. Food is the fuel which gives us our energy.
We turn some of the food we eat into energy; we use up energy when we move our arms and legs. Our hearts and our lungs use up energy day and night. Our bodies use up energy in just keeping us warm.

2.* We need to eat the proper foods to build and maintain our bones, teeth, muscles, and nerves. We can get the materials our bodies need by eating the proper foods at mealtimes. These are available in four broad groups--the milk group, the meat and fish group, the vegetable and fruit group, and the cereal group. Each of these groups help the body to do a special job.

Parts of us get damaged and wear out by being used, such as our muscles and skin, and the food we have eaten repairs and replaces them. If we do not eat the right foods, the body uses some of its own tissues as building materials. When this happens, we get listless and lack energy. Lack of proper food could retard our growth.

Our bodies are more wonderful than our parents' automobiles -- they can repair themselves and keep themselves in good running condition. Our skin, muscles, and bones are examples of tissues. When we break a bone, our bodies can repair it. A doctor, of course, sets the bone in place so that it grows together properly.

3. We need food from the milk group. This group, which includes milk and the foods made from milk, makes strong bones and teeth and helps our bodies to grow. Have the children name as many foods made with milk as they can: cheese, butter, custard, ice cream, etc. As growing children, they need a quart of milk in their daily diet.

The children are interested in learning how milk is processed. They enjoy learning about pasteurization, how it kills germs in the milk, and why milk must be kept clean after pasteurization.

The children might be interested in learning that chocolate milk is skim milk (milk that is left when the butterfat has been taken away) and is not as good a food as regular milk. It is more expensive than regular milk and has sugar and chocolate added to it.

Have the children draw pictures of food made from the milk group. A Series of six posters entitled, "Milk From Farm to Family," available through the Dairy Council, could be used profitably here.

Another series of posters, "Milk Made the Difference," is available through the Dairy Council and graphically shows the need of milk in the diet of growing animals. There are striking contrasts in the growth of young animals that were fed a combination of foods typical of that recommended for growing children including milk, and animals on the same diet when milk was omitted . A trip to the Wawa dairy would be an exciting experience for the children.

The children enjoy making butter. Skim the cream from the top of a quart of regular milk. (Do not attempt this with homogenized milk because the fat globules have been broken up into minute particles and cannot rise to the top and be removed.) Put the cream in a mason jar, put the lid on tightly and shake. After shaking for about twenty minutes, lumps of butter begin to appear in the liquid.

The first butter was probably made by accident. People of long ago used animal skins to hold milk and a person who carried a skin bag full of milk on a jogging horse would find butter floating on the milk.

4. We need food from the meat and fish group. The foods in this group help to build every part of our bodies. They make us grow and they make us strong. Since the children are growing, this food group is very important to them. We should have two or more servings of this food every day.

   Dried peas, beans, and nuts give our bodies many of the same things that meat and fish give to us; these are cheaper but poorer food sources than the meat and fish. Except for the peas, beans, and nuts, all of the foods in this group are animal products.

   Make a list of the various meats the children eat at home, such as pork, veal, poultry, lamb, beef, etc. Have the children name some of the fish they know: sardines, crabs, lobster, etc. Make a wall chart of the meats, fish, and poultry that would be included in this group. Discuss how these foods are made available to us; they are canned, frozen dried, smoked, pickled and refrigerated.

5. We need food from the vegetable and fruit group. The vegetable and fruit group helps us to maintain healthy teeth and gums, to see better in the dark, and to prevent eye diseases. The vegetables include the dark green and yellow; included in the fruit group are the citrus fruits and the tomato. We need four or more servings of this food group daily.

The children could identify the parts of the vegetables that we eat:
leaves: Lettuce, cabbage, watercress, parsley, spinach
stalks: celery, asparagus
roots: beets, carrots, turnips, parsnips
seeds: corn, peas, beans
flowers: cauliflower, artichoke, broccoli
pods: string beans, okra, Chinese peas
fruits of vines or plants: tomato, cucumber, squash, eggplant

A good activity here would be the growing of vegetables. Most vegetable seeds break through the soil in a week or ten days. If vegetables are grown, a notebook could be kept by the children in which they record their daily observations;
If enough vegetables are harvested, they could be used in preparing a nutritious meal.

6. We need food from the cereal group. The cereal group includes wheat, rice, oats, rye, and corn. These foods are what give us the energy we need for work and play. We need four or more servings of these foods daily. Make up a list of some of the foods made by using grains, such as; wheat bread, corn flakes, oatmeal, rye bread, graham crackers, hominy grits.

The children will be surprised to learn that the cereals were once wild grasses that early man learned to eat. When early man learned that he could plant the seeds of these wild grasses himself, he became a farmer. The bread of the world is made from the cereal grasses. Ask the children to bring in any cereal grains they have at home in their natural state.

7. The poster, "Every Day Eat the 1-2-3-4 Way" illustrates the four basic food groups and is available through the Dairy Council. So are the posters, "My Breakfast to Start on My Way," "My Lunch For a Happy School Day," "My Snack--What Ones Today?" "My Dinner After I Play." These posters can be used to make up experience stories.

The chart, "Food for Health in the Delaware Valley," can be used to show which of the four types of basic foods are available to us who dwell here. The chart can be a basis for discussion of what foods we must get from other parts of the country or from foreign countries

"The Happy Song Book" and "Health Notes" are books of songs that the children will enjoy learning and singing and which stress good health habits. (Dairy Council.)

8.* Should the children ask about vitamins or minerals, a short discussion of these vital nutrients may be necessary. All foods contain nourishing ingredients called nutrients. Nutrients are substances needed by the body for growth, repair, and energy.

Vitamins are not food but chemicals obtained from many different foods which our bodies require in tiny amounts. Since our body cannot manufacture vitamins, it must get them from the food we eat. The body needs to have vitamins every day; two glasses of orange juice one day will not make up for the glass of orange juice [illegible] should have had the day previously. The body cannot store up vitamins.

The lack of vitamins will give us deficiency diseases. Years ago when sailing ships roved the oceans and refrigeration was unknown, the sailors on long sea voyages often got a disease called scurvy. This disease was characterized by bleeding gums and sore, swollen joints. When the sailors began to be given lime juice in their diet, this disease disappeared. We now know that the lime juice contained Vitamin C; other rich sources of Vitamin C are the citrus fruits, tomatoes, and cabbages.

Rickets is another deficiency disease and it results in crooked bones; Rickets was caused by a lack of Vitamin D -- the "sunshine vitamin." Vitamin D is formed by the action of sunlight on a chemical substance in the skin. When we cannot get the sun, such as in the wintertime, our parents give us cod liver oil which is rich in Vitamin D.

The body needs other nutrients called minerals to work properly, too. These minerals are calcium, phosphorus, iron, and iodine. These minerals are found in the following foods:
Calcium is found in milk and hard cheeses,
Phosphorus is found in meat and most vegetables,
Iron is found in eggs, whole grain cereals, and liver,
Iodine is found in sea foods and now in "iodized" salt.
Before the day of regrigerated railroad cars and "iodized" salt, people who lived from the seashore and hardly ever had any fish in their diet developed goiter, an enlargement of the thyroid gland. The thyroid gland needs the mineral iodine to remain healthy.

A diet is the foods a person eats--a diet can be a good one or a bad one. Nutrition is the science of sound eating. The four food groups will help us to get all the nutrients we need for a good diet.

Have the children identify the foods in the four food groups which contain the vitamins and minerals mentioned above.

9.* Food must always be well chewed because it helps the stomach to digest and absorb the foods we eat better. Digestion begins in the mouth where the food is cut and ground by the teeth and mixed with the saliva--the children can see the necessity of chewing food well and not just bolting it down. We should not wash down quantities of food with liquids just to avoid chewing the food well.

Stress the importance of eating meals in a happy atmosphere. If there is quarreling or scolding at mealtimes, the normal processes of digestion stop. Unless the foods are properly dissolved in the stomach, they cannot be properly utilized by the body. After eating it is wise to rest; if we run about, the body must not only supply us with energy but digest the food we have eaten.

10. If we eat candy or other "sweets" as our between-meal snacks, we do not get the other important nutrients that our bodies need. If we eat sugar in our snacks, we will feel full and will not be able to drink the milk or eat the meat vegetables, cereals, and fruits that are vital for growing and for good health. We can get enough natural sugar if we eat fruits for our snacks.

Have the children make up a list of good food snacks, such as fruit juices, milk, fresh fruit, celery, and carrots. These foods stop our hunger pangs and give us the needed nutrients for a good diet. The poster, "My Snacks--What Ones Today?" already mentioned in activity seven can be valuable here.

RESOURCE PEOPLE

Miss Drawbaugh, the Dairy Council, LO [illegible]-5391. If Miss Drawbaugh is not available, ask for one of the other nutritionists. If you wish to pick up materials personally, go to the Dairy Council at 234 S. 22nd St., Philadelphia.

For trip to WAWA Dairy on Baltimore Pike call, Mrs. Shellender, LO 6-6500. Trips last one hour and are only available during the morning.

FILMS

Bread 134	Phila. Suburban Film Library
Cattle Drive 212	" " " "
Dairy Farm, 301	" " " "
Mealtime Manners and Health 888.01	" " " "
Poultry on the Farm 1114	" " " "
Three Squares a Day 1389	" " " "

FILMSTRIPS

Finding Out How You Grow 424-3	Society for Visual Educ., Inc.
Farm Animals 435-14	" " " " "
The Story of Milk 203-1	" " " " "
The Story of Bread 203-2	" " " " "
The Story of Fruits and Vegetables 203-3	" " " " "
The Story of Meat 203-4	" " " " "
Let's Have a Party 567-1	" " " " "

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ELEMENTARY SCIENCE REVISION - 1962

EVALUATING THE UNITS

THIRD GRADE

Gerald Craig wrote, "It is generally assumed that boys are more interested in electricity, mechanics, and other physical science subjects than are girls. What usually is not recognized is that the home and the school normally tend to condition girls from early childhood away from these interests which traditionally have been considered masculine. ... But the modern housewife is one who operates a wide variety of electrical and mechanical equipment in her daily work ... . The average woman has much need to know about the proper use of electricity as the average man, if not more so. ...There should be no discrimination in science on the basis of sex."[1]

In third grade our study of Living Things ("Seeds" and "Animal Ways"), Non-Living Things ("Air") and Energy ("Magnets" and "Electricity") continues. Unless the teacher is careful, it is about this time that certain boys in the classroom begin to "take over" the science classes. If this happens, it is because the teacher allows it to happen. Far from helping anyone, this condition usually creates unfounded feelings of scientific superiority on the part of a few and unfounded feelings of scientific inferiority on the part of many. If the material is kept simple, as it should be, and if all are encouraged to participate, there is no question but that practically everyone will become deeply involved. Under these conditions, it is possible, and even desirable, that all the children will "take over" the science class - under the expert guidance of the teacher.

The fourth grade evaluation sheets point up this tendency for a few boys to dominate in certain area. Children's reactions to "Seeds," "Animal Ways," "Air," "Magnets," and "Electricity" are reported as uniformily enthusiastic, but references to "the boys" are rather common by the time "Electricity" is reached. As mentioned above, this is to be expected, but also guarded against.

Since the evaluation sheets were so favorable, no basic changes were made in the third grade units. The activities for "Air" were hopelessly mis numbered, so a revised edition of this unit is included.

Additional suggestions that were made for the other units are listed on the next page.

The new health unit "A Sound Mind in a Sound Body" is also included.

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[1] Science For Today's Children, Ginn, 1958, Pg. 21.

Additional Suggestions for Teaching the Units

ANIMAL WAYS

This unit is a comprehensive one therefore, it is necessary to be selective in the choice of activities.

Mrs. Robert Smurthwaite is not able to present her program to groups at this time.

Puppet shows featuring animals can illustrate many of the concepts mentioned in an entertaining way.

SEEDS

Collect seed packets and pictures of flowers from seed catalogues.

Activities 3 and 8 should be combined.

Activity #13 is particularly recommended.

This unit could be divided into parts. The section developing the many kinds of seeds and their dispersion could be taught in the fall, and the growth of seeds could be taught in the spring.

Make drawings of the matching seeds and leaves of dogwood, firethorn, and holly.

MAGNETS

Activity 27 refers to the fact that refrigerators, vacuum cleaners, and freezers have an electric motor, and that every electric motor has an electromagnet in it.

ELECTRICITY

Dry cells, switches, bulbs, wires, and electric bells wear out. Anticipate your needs and order a year ahead.

Pictures from pgs. 473, 475, 476, and 479 of Blough's book were drawn on the board and proved very helpful.

Grade 3

SEEDS

The children will be interested to realize that plants, like everything else in the world must reproduce their kind or disappear forever. To comply with nature's rule, plants produce seeds in great quantity, and because of their variety in structure nature employs numerous means of spreading them to new areas. Recognized for their food value in the man and animal world alike, the uses of seeds are many.

CONCEPTS

The seed contains a tiny plant. (2-3)
The flower is the part of the plant which produces seeds. (4-5-6-7)
A large number of seeds are produced by the plant. (8-9)
EACH FLOWERING PLANT PRODUCES ITS OWN KIND OF SEED.

Seeds need water and sunshine to grow. (10-11)
Seeds grow at different rates. (12-13-14)
SEEDS HAVE NEEDS FOR GROWTH.

Some seeds vary in size. (15-23)
Some seeds have wings. (16)
Some seeds have hooks or barbs. (17)
Some seeds have fluff. (18)
Some seeds are contained in fruits, nuts, and pods. (19-20-21-22-23)
THERE ARE MANY DIFFERENT KINDS OF SEED COVERINGS.

Some seeds drop to the ground. (24-25)
Some seeds are carried by the wind. (24-25)
Some seeds are carried by animals. (24-25)
Some seeds travel on the water. (24-25)
Some seeds are shot from the plant. (24-25-26)
SEEDS ARE MOVED ABOUT IN MANY WAYS

Seeds are used for food. (27-28-29-30-36)
Seeds are stored by some animals. (31-32-33)
Seeds are used for clothing. (34)
Seeds are used in medicine. (35)
SEEDS CAN BE USED IN MANY WAYS.

MATERIALS

Blotting paper
Dish
Sawdust
Seeds
String
Pan
Flat stone
Grater

Tooth picks
Plate and cover
Sand
Magnifying glass
Electric fan
Piece of glass
Grains of wheat
Large box lids

Cotton
Glass
Pebbles
Woolen cloth
Knife
Round stone
Ears of corn
Glue

Grade 3

TEXTBOOKS

1 - 1 : 76-77
1 - 2 : 15-17
1 - 3 : 60-61
1 - 4 : 45-46; 49; 129-135
2 - 1 : 103-116
2 - 2 : 35-36; 190-194
2 - 4 : 118-133
3 - 1 : 58-59
3 - 2 : 68-77
3 - 3 : 60; 68-69
3 - 4 : 197-199

ACTIVITIES

1. Motivation: Plan for an "Autumn Show"; include such entries as vegetables, fruits, seed and leaf collections, flower arrangements.

2. As an experiment the children will want to examine seeds to see their structure. Lima beans are good to examine, because the parts are large and can be easily seen. Soak the seeds in water overnight (to hasten germination). Leave them on moist blotting paper for one or two days. Now the germinating parts can easily be distinguished. The children can use toothpicks to take the seed apart. They may look for the three parts of the seed (coat, tiny plant, stored food). After they have identified the parts, they may discuss the function of each part.

3. Have the children bring in some bean pods and pea pods. Open the pods to show the seed inside. Then cut open a few of the seeds to show that each seed contains a baby plant.

4. Ask the children to bring autumn garden or wild flowers to school. See how many flowers the children can name. If possible, have books with pictures to help them identify the ones they do not know. Discuss what they would have to do to get these flowers in their gardens. Encourage a discussion of planting the seeds. All this discussion emphasizes the fact that many plants depend on seeds to produce flowers. In a similar way, flowers are necessary to produce seeds.

5. Obtain a bunch of sweet pea blossoms. Give a blossom to each child and have him gently pull away the petals. He will find a tiny pod, shaped exactly like a full grown one. Slit open several of the tiny seeds inside. Tell the children that in many other flowers we can see little pods and the tiny seeds inside.

6. Trace the life cycle of a plant. Plant a larkspur or other flowering plant. Refer to pictures in Look and Learn, Scott Foresman, Pages 58 and 59.

7. Make a film strip of the life cycle of a plant by using seeds, young seedlings, pictures from garden catalogues, etc.

8. Have the children bring in flowers that have dried and are forming seeds. The dahlia is a good example of this.

9. In the classroom, plan games and contests to help the children identify the more common seeds in their environment.

10. The class could sprout large seeds to see how a seed grows into a plant. Observe to see what happens and keep a record of the observations in the order in which they happen. The record may be illustrated by simple drawings to show growth. Seeds may be sprouted in a number of different ways: on moist blotting paper or cotton in a covered flat plate or dish; next to the glass in soil using a glass tumbler so that pupils can watch the roots grow down and the stem grow up; or directly in soil.

11. Plant a small garden to discover the different sizes and shapes of seeds, how seeds are planted, how long it takes them to come up, how they change as they grow, and how they need to be cared for.

12. An experiment: A child could place a piece of paper towel around the inside of a drinking glass. Then put some grains of corn between the towel and the glass. Keep the towel damp but not wet. Plant other kinds of seeds this way. Watch them grow. Keep a record of what happens.

13. Plant some grass seed in soil. Plant some in saw dust. Plant some in sand. Put others on pebbles. Water them a little every day. Which grow best? Why? It will take a long time to answer this.

14. Sprout five different kinds of seeds. Plan an exhibit to show likenesses and differences in the ways in which these seeds change as they germinate and begin to grow.

15. Collect various kinds of seed cases, examine them to determine types of cases and sizes of seeds within. Observe arrangement of contents, examine with a magnifying glass.

16. Find some seeds with wings. Drop some from a high place. Drop some from a low place. Drop them when the wind is blowing. Discuss what happens.

17. This is one way to collect some seeds. Tie a woolen cloth to a string. Drag the cloth through some weeds. Try to find many kinds of seeds that stick to animals.

18. The children could collect and bring to school some seeds with fluff that would be scattered by the wind such as dandelion, milkweed, thistles, etc. These seeds could be taken outside on a windy day and each child would have an opportunity to disperse his seed. (If it is not a windy day, the children could blow the seeds or an electric fan could be used in the classroom.)

19. Cut a variety of fruits. Observe how seeds are protected, the parts of a seed, and the number of seeds found.

20. Have placed on the science table five fruits. Can the children name them? The children can find the seeds inside these fruits. (Suggested fruits: peach, cherry, pumpkin, tomato, and watermelon.) The children can count the number of seeds they find.

21. Hold "tasting" parties; introduce new fruits, such as kumquats, avocados, pomegranates, persimmons. Look for seeds.

22. In this activity note that seeds and nuts keep much better than some other foods. Place tomato, lettuce and apple on one plate and seeds and nuts on another. Leave these foods for a few days. Explain that one reason why the tomato, lettuce, and apple spoiled was because they have a lot of water in them, which dries out, and that the seeds and nuts have very little water in them to dry out. Another reason is that the seeds and nuts have hard coats, which protect them.

23. Have the children bring in many pea pods. Examine the covering; then open and count the number of seeds found in each pod. Keep a record of the number of peas found and the variation in size. This could also be demonstrated with lima bean pods.

24. Have the children collect seeds and bring them to school. These seeds could be placed on one of the five charts to tell how each kind is dispersed. The charts could read as follows:
    Seeds Dropped to the Ground
    Seeds Carried by the Wind
    Seeds Carried by Animals
    Seeds That Travel on Water
    Seeds Shot From the Plant.

25. Make up guessing games about seed travel.

26. Dig up some soil from a garden. Put soil in a pan. Cover the pan with a piece of glass. Watch the soil for several days. Does anything grow from it? Can you tell why there are plants growing?

27. The children could find advertisements of food or labels from foods which are seeds. These advertisements or labels could be made into a bulletin board display.

28. The children could make wheat flour the way people did years ago. The children will need a round stone, a flat stone and some grains of wheat. Then crush and grind the grains of wheat between the stones. Keep grinding until the grain is very fine.

29. The children could make corn meal from some ears of dry corn. The dry ears of corn could be grated and the corn meal collected into a pan. The children could then discuss the use of corn meal.

30. The children could make rolled oats by pounding oat grains carefully. Pounding the grains makes the covering come off.

31. A trip to the woods to call attention to the animals there and to watch squirrels hunt for nuts and hide them. Encourage the children to pick up nuts and collect seeds of plants. Conservation should be the dominant theme here. Help the children to see that one specimen to bring back to the classroom for further study serves the purpose as well as a large number.

32. Each child could make a booklet about animals that eat seeds. Collect or draw pictures of these animals and the seeds they eat.

33. In visiting a farm home, look at winter quarters of the various animals and see where the winter food is stored for the animals. Find out how food has been preserved for the family by canning, salting, pickling, freezing, drying and dry storage in a cold cellar.

34. Encourage children to make drawings with labels for a large chart entitled: "Seeds Used for Clothing" or "Clothing Made from Seeds".

35. Visit the local apothecary shop or drug store to talk with a pharmacist or druggist about the seeds used in medicine. A display of nonharmful drugs could be made for the classroom. For further information consult the Encyclopedia Britannica.

36. Have the children collect many kinds of seeds. A large box lid, paint, glue and labels will be needed. Paint the inside of the large box lid a bright color. After it has dried the seeds and labels could be mounted in the lid. Each child then has his own seed collection.

37. Is birdseed a single kind of seed, or is it a mixture of different kinds? To find out, sprinkle some birdseed on a moist sponge and put the sponge in a shallow dish of water. In a few days the seed should begin to sprout. Do all the young plants look alike?

RESOURCES

1. State Agricultural College and experiment stations for information about seed growing experiments

2. Hardware dealer for supplies, seeds, and seed catalogues

3. Local garden club
4. Florist shop
5. Greenhouses
6. Local apothecary shop or drug store

RESOURCE PEOPLE

1. Garden club member
2. County agriculture agent
3. Florist
4. Druggist or pharmacist
5. Nurseryman
6. Forester

Grade 3

FILMS

Garden Plants and How They Grow	Coronet Instructional Films
Seed Dispersal	Radnor Film Library

FILMSTRIPS

Flowers, Fruits, and Seed -Row, Peterson and Company
Let's Learn About Seeds -McGraw-Hill Science Filmstrips
Finding Out How Plants Grow -SVE
Seeds and Seed Travels -SVE

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ANIMAL WAYS

Several major science learnings are developed in this unit such as the adaptation of animals to their environment, the building of a variety of homes, the securing of food in different ways due to a variety of physical characteristics and the self-protection of animals from their enemies. Science learning concerned with group living, are more readily understood through the observation of the ways animals, as well as man, adjust to community life. A broad science learning is the realization that man, being more highly developed, is able to make a wider range of adaptations to conditions under which he must live.

CONCEPTS

Animals may be seen in many places. (1-3-21)
Some animals are very large. (2-21)
Some animals are very small. (2-21)
Some animals can change their shapes. (4)
Animals vary in their body coverings. (5-6-21)
THERE ARE MANY DIFFERENT KINDS OF ANIMALS.

Some animals live solitary lives. (40)
Some animals live in social groups or communities. (8)
Some animal homes are in water. (7-12-21)
Some animal homes are under the ground. (11-21)
Some animal homes are used for traps for other animals. (16)
Animals use varied materials to make their homes. (15-21-7-8)
Some animal homes are above the ground (10-21)
ANIMALS MAKE AND USE A VARIETY OF HOMES.

Animals need food to live. (13-14)
Not all animals eat the same kind of food. (14-21)
Animals that eat only meat are called carnivorus animals. (17-21)
Animals that eat only plants are called herbivorous animals. (17-21)
Animals that eat both meat and plants are called omnivorous animals. (17-21)
ANIMALS EAT MANY DIFFERENT KINDS OF FOOD.

Some animals fly after their food. (18-21)
Some animals run after their food. (18-21)
Some animals swim after their food. (18-21)
Many animals use other parts of their bodies than their mouth to help them get food. (19-20-21)
Animals get their food in different places: in the air, on the ground, in the water. (10-18-19-21)
ANIMALS GET THEIR FOOD IN DIFFERENT WAYS.

Many animal body colors are similar to the color of their surroundings (23-27-29-30-32)
Some animals resemble their habitats not only in color, but also in shape. (29-30)
Some animals feign death or injury. (26-29-30)
Body coverings of shells, spines, quills and horny skeletons protect some animals. (23-24-29-30)
Many animals depend upon swift flight as a means of escaping from danger. (23-28-29-30)

Some animals produce obnoxious odors when aroused. (29-30-31)
Many animals possess natural weapons which are useful defenses. (22-25-28-29-30)

THERE ARE MANY WAYS IN WHICH ANIMALS PROTECT THEMSELVES FROM ENEMIES.

Some animals hibernate during all or part of the cold season. (39)
Some animals migrate to warmer climates during the cold months of the year. (36)
Many animals grow thicker coats during the winter season. (3)
Many insects undergo changes during their lifetime. (9-34)
Some animals store food for the winter. (37)
Some animals complete the life cycle in autumn and die. (9-34)
Some animals find food throughout the year and are active in all seasons. (3-37)

ANIMALS MAKE CHANGES THROUGH THE YEAR.

MATERIALS

- Clay
- Ant colony
- Specimen cases
- Labels
- Flower pot
- A dowl stick
- Quills of porcupine
- Grass seed
- Two broomsticks
- Wall paper paste
- Alcohol
- Cigar boxes
- Glass or cellophane
- Corrugated pasteboard
- Thermometer
- Magnifying glass
- Grasshoppers
- Shoeboxes
- Aquarium
- Cotton
- Wooden packing box
- Nails
- Hammer
- Wire insect cage
- Dead bumble bees
- Cocoons
- Large roll of shelf Paper

TEXTBOOKS

1 - 1 : 10-22; 88-91
1 - 2 : 18-21; 66-69; 92-97
1 - 3 : 4-45
1 - 4 : 21-33
1 - 5 : 128-139
2 - 1 : 43-52
2 - 2 : 30-32; 81-82; 101-106; 168-173
2 - 3 : 24-31; 131-146; 164-177; 180-186
2 - 4 : 61-62; 134-140; 144; 156; 160-161
3 - 1 : 6-9; 14-23
3 - 2 : 3-28
3 - 3 : 3-36
3 - 4 : 19-37; 62-63; 183-196

ACTIVITIES

1. Motivation - Since animals are high on the list of children's interests, the teacher might begin by finding out how many animals the children can recall having seen during their summer trips, vacations at lakes or woods, or excursions to zoos or parks. A child's new pet which has caught the interest of his friends may center the children's attention on animals they would like to have as pets or that they have never seen as pets.

2. The children could make a list. On this list could be written all the animals which the children in the class have seen. Two charts could emerge as the children refine their thinking. One might be titled "The Largest Animals We Have Seen" and another "the mallest Animals We Have Seen." In addition to listing the names of animals, the children might draw pictures of them beside the names, or collect pictures of the various animals to place opposite the names on the chart.

3. The children could visit a farm, park or sanctuary to see the variety of animals.

4. The children could model animals with strange shapes from clay or paper-mache' (giraffe, snake, etc.). This activity could be used for room and hall displays.

5. The children could be divided into groups. One group of children could bring in pets or stuffed animals with body covering of feathers. The second group could bring in animals (pet or stuffed) with body covering of fur. A third group could bring in animals (pet or stuffed) with a body covering of scales or hard shell. This could be followed with a discussion of the variety of body coverings found on animals.

6. Make a fur chart. Mount little pieces of different kinds of fur, or pictures of different things made from fur, on the chart. Under them put pictures of the animals from which each came. This activity could also be developed with feathers, scales and hard coverings.

7. An acquarium in the class room is very helpful in the study of animals. Fish, snails, tadpoles, and small turtles may be kept very easily. An acquarium made by the children is much more fun and more useful to them. The children may begin by discussing such questions as "What kind of place shall we make for the fish?" What materials shall we need?" "Where canwe get them?" "How should we use them?" (For informatio on how an acquarium should be set up consult Blough or Craig.)

8. An ant colony makes an interesting study of animal social groups or communities. (see Blough or Craig)

9. For an insect collection the children could use moistened cotton with alcohol to kill the insects. Specimens should be carefully checked to determine whether they are insects; and acceptable specimens can be kept in a regular specimen case, in shallow cotton-lined boxes tightly covered with glass or cellephane, or in cigar boxes lined on the bottom with corrugated pasteboard. Tell on labels whether they grow up in three or four stages. (Pamphlets on the collecting and mounting of insects may be obtained from any state university or museum of natural history.)

10. The children could make a satisfactory feeding table from a wooden packing box. Provide a slanting roof and leave at least two sides closed for protection. Mount it where it could be easily observed from the classroom. Birdhouses, feeding stations and bird baths should resemble natural conditions as nearly as possible, should be safe from cats, and should be put where they can be seen by the children.

11. The children cannot make a real prairie-dog tunnel in the classroom. They can make a little tunnel and do an experiment with it.

The children would first get a flower pot full of dry earth. Make a deep hole with a dowl stick. This is the tunnel. The flower pot would then be put in the sun for a while. The children would then feel the earth on top of the pot. One at a time, they could put their fingers into the hole. A thermometer could be used next. The children could conclude that a deep tunnel is a good home for a prairie dog who lives where it is hot and dry. (A clay model of a prairie-dog tunnel could be made.)

12. The children could make a class painting of undersea life.

13. Encourage the children to tell humorous stories of adventures their pets have had while searching for food. Discuss ways in which pets must be cared for, and list the rules a good master follows in bringing up a pet.

14. Observe the kinds of food local animals eat, stressing the variety oof most diets. Children are apt to have erroneous preconceived ideas, such as that cats eat only milk, dogs eat only meat, birds eat only worms, etc. This erroneous preconception should be changed and the wide variety of foods acceptable to many animals should be stressed. Discuss the importance of food as a factor in growth, life, and health of human beings (children).

15. The children could make booklets of pictures and stories of different animal homes stressing where they would be located and of what materials they would be made.

16. If possible collect some spiders. Put them in a wire cage. Watch them spin webs. The children could look for pictures of the black widow and tarantula spiders. Also see "Spiders," (Radnor films)

17. The children could make three charts listing animal names, picture of the animal and a story about this animal. The charts could be entitled: "Meat Eating Animals - Carnivorous," "Plant Eating Animals - Herbivorous" and "Meat and Plant Eating Animals - Omnivorous".

18. The children could make a series of pictures or paintings showing that some animals fly after their food, some animals run after their food and some animals swim after their food. These pictures and stories could be pasted on a roll of shelf paper which serves as the film. Two rollers (broom-sticks) need to be inserted in opposite ends of a box which is large enough to hold the film.

19. Several charts may be developed. One might be called "How Animals Use Their Feet to Get Food" On this chart children may list all the animals they know which use their feet in getting food. They may wish to draw pictures of each of these animals to go on the chart. They would doubtless include the hawk, owl, monkey, kangaroo, eagle and squirrel. Another chart might be titled "How Animals Use Their Noses and Beaks to Get Food." The heron, pelican, duck and elephant could be among these pictured.

20. Dramatics - Children enjoy impersonating people and animals.

Children could portray different animals seeking food. One child at a time could give an impersonation of an animal feeding, and the remainder of the class as the audience might try to guess which animal the child is imitating.

21. Children may record some of the information they have learned about animals and their food habits by making a large mural or frieze. The many food-getting adaptions of animals, as well as the differences in sources and kinds of food, may be graphically shown in such a mural.

22. Look at the claws of a kitten and the teeth of a pet dog. Note how the kitten can extend its claws when ready to defend itself. Look at the two long canine teeth in the upper and lower jaws of the dog. See how well their shape and size are suited to holding and tearing.

23. Take a trip to a zoo or natural history museum. Try to find animals that escape from their enemies by moving sway quickly, camouflage, going inside hard shells, using quills or varbs, or fighting.

24. If some are available, examine the quills of a porcupine under a magnifying glass. Note how the end attached to the porcupine is relatively smooth. Look at the other end and note the many barbs. These barbs make a porcupine quill stick firmly in any animal that gets close enoug to "porky" to receive one.

25. Children could dramatize how the opossum feigns death in order to escape from his enemies. (Refer to story of opossum in Scott-Foresman Grade 3- Reading)

26. Have children bring to class a dead hornet, bumblebee or wasp. Make it understood that the children are not to go out and kill these insects. With a magnifying glass, look at their stings. Note the shap and structure of these animal weapons. (Parents may have used a spray to kill insects. If insects are not available, pictures could be used)

27. Experiment - A child should take a sheet of white paper and a sheet of dark paper outside and hold them over his head. Which one is harder to see against the bright sky? In the same way, it is harder to see the white underside of a frog. A fish looking for a frog to eat cannot see it easily because the fish is underneath, looking up at the frog. against the bright sky. (E.g. chameleons, praying mantis, sea gulls, tadpoles)

28. Children could illustrate some of the protective devices in clay models, in sketches or in murals. A horse or deer with its long legs could show speed, animals with sharp teeth could show biting, etc.

29. See the five curriculum filmstrips on animal protection.

30. This activity could be used as a game to stimulate further interest. Have the children make suppose-statements about how animals possess natural weapons for defense, e.g. "Suppose a porcupine had no quills."

31. The class could discuss how animals protect themselves by noxious secretions. In furthering the interest a list of such animals such

animals such as the skunk, toad, ladybird beetles and the common carrot caterpillar could be made.

32. By playing a game of detective the child could study a series of pictures or photographs to see if they could find the animal in the picture. Most of the animals in the pictures would not only resemble their background in color but also in shape. Each child could keep his own score.

33. The children could make scenes depicting different habitats; e.g., desert, forest, water (lake, sea), etc. (Shoe boxes could be used.) Small painted clay animals made by the children could be placed in their natural habitats (in the shoe boxes) or moved to other habitats, noting that many of the animals' outer coloring blends or is contrasted to his background.

34. Make two charts showing the differences between moths and butterflies. See SVE filmstrips: "Life Cycle of the Monarch Butterfly" and "How Insects Live and Grow."

35. Collect grasshoppers. Plant grass seed in an empty aquarium tank to furnish food for them. Cover the tank with wire screen so the grasshopper can't escape. Keep the tank all winter. Some of the grasshoppers may lay eggs in the ground. In the spring you can see the nymphs.

36. List the birds which fly away in autumn. Discuss where they would fly. Suggest that the children watch for migrating birds. Visit a bird Sanctuary.

37. Two very good field trips are a trip to a woods to see evidences of animals preparing for winter and a trip to a farm home to see how man prepares for winter.

38. Coccoons can be brought in and kept in a glass jar with a perforated top for air to enter. Inspect them frequently, since the adults will emerge during the winter months in the warmth of the classroom.

39. The children could make a list of the animals that hibernates during all or part of the winter. If you have a hamster at school, it may begin to hibernate if the room becomes cold. It will wake up when the room becomes warm again.

40. Discuss with the children that only a comparatively few animal species are truely solitary. Eagles build their nests miles apart, and such birds as hawks are not found together in large groups. Mention also some habits of some of the insects.

41. The children could collect information concerning the different ways in which people can conserve wild life. Such an activity should not be confined to winter feeding but may include such matters as game laws for protection, national animal reserves, fish hatcheries, and lake stream stocking.

42. A quiz game could be used as a culminating activity.

RESOURCE PEOPLE

1. Vetinarian 2. Bee-Keeper 3. Game Warden
4. Entomologist (specializes in the study of insects)
5. Mrs. Robert H. Smurthwaite, Vernfield, Pa. Call CL 6-8991. Conservatio of living things program - ½ hour to one hour. Program to be held in school or a trip to a stream and field.
6. Furrier

RESOURCES

1. The Philadelphia Academy of Natural Sciences, 19 Street and the Parkway, Phila. 3, Pa. Call: RI 6-7622. Contact: James A Fowler, Director of Education. Notify one month in advance. Admission charge of 20¢ per child. Museum guide 25¢. Tour takes approximately one hour.

2. Fairmount Park Zoo, Phila., Pa. No limit. (contact directly)

3. Pennsylvania State Fish Hatchery, Torresdale (on the waterfront), Phil Pa. Call: MA 4-2846 Contact: John Wopart - Notify one week in advance. Open all year, but best time to visit is between April 15 to May 15 and between October 1 to November 15.

4. Middleton Pigeon Farm, Marshall and Whitehall Road, Norristown, Pa. Call: BR 2-3207 (Bird Sanctuary). Contact: Mr. Raymond Middleton, President of Audubon Society, 131 N. Whitehall Road, Norristown, Pa.

FILMS

Animals in Winter - Encyclopedia Britanica
How Nature Protects Animals - " "
Beach and Sea Animals - " "
Seashore Life - " "
Camouflage in Nature - Coronet Films
Through Form and Color Matching "
How Animals Move - Young America Films, 18 E. 41st. St. New York 17, New York
How Animals Defend Themselves " " " "
How Animals Eat " " " "

Animals in Winter - Radnor Films
The Beaver - " "
Birds Are Interesting - " "
Birds of the Countryside - " "
Birds of the Marshes - " "
Birds of Prey - " "
Birds of the Seashore - " "
Common Animals - " "
Frog - " "
Honey Bee - " "
How Animals Defend Themselves " "
Life in the Ocean - " "
Monarch Butterfly Story - " "
Seashore Life - " "
Spiders - " "

FILMSTRIPS

Animal Protection (group of 5 filmstrips in color) - Curriculum Filmstrips
1. Body Covering   2. Protective Coloring   3. Using Protective Coloring
4. Protective Weapons   5. Protective Behavior
Homes of Birds - SVE
Backyard Insects "
Life Cycle of the Monarch Butterfly - SVE
Life of the Honeybee - "
How Insects Live and Grow - "
Frogs, Toads, and Turtles and How They Grow - SVE
How Birds are Fitted for Their Work - SVE
Animal Homes - McGraw Hill Science Filmstrips
Animals Around the World - " " " "

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Thunder Wings: The Story of a Ruffed Grouse. William Morrow, 1951

LOWER MERION SCHOOL DISTRICT

THE CARE OF LIVING SPECIMENS IN THE CLASSROOM

Animals	Habitat	Controlled Habitat	Food	Cause of Failure	Remarks
Ants	Common on the ground everywhere	Miniature vivarium tight fitting top	Sugar, fat, honey-water	Development of molds lack of water	
Caterpillars	Common everywhere	Insect cage, glass jar with screened top, screened box	Plenty of fresh leaves from plant specimen on which found	Lack of food and moisture	Should be isolated
Cocoons	Found on trees and bushes in fall and winter	Fasten outside window. If kept inside, sprinkle lightly with water each week	None	Lack of moisture. Too warm	
Crayfish and Shrimp	Ponds	Semi-aquatic in balanced aquarium	Earthworms Fresh meat	Over-crowding Drowning	Provide rocks or other hiding places
Earthworms	Gardens or lawns Rich soil	18" of soil, leaves, grass, and sphagnum moss, wooden container	Lettuce Vegetation Leaves	Over-stocking Too much heat Lack of moisture	Keep cool Keep tub covered
Frogs	Ponds	Semi-aquatic aquarium	Mealworms Flies Earthworms	Too sudden change of temperature	Screen top of tank for ventilation
Toads	Woodlands Gardens	Woodlands aquarium or semi-aquatic	Mealworms Flies Earthworms	Lack of moisture	Provide leaves and branches for shelter. Do not keep with salamanders
Frog eggs	Ponds	Balanced aquarium in pond water	None	Chlorine in tap water	
Toad eggs	"	"	"	Over-crowded	
Tadpoles (Frog, toad, salamander	Ponds	Balanced aquarium	Tropical fish food	Over-crowding	

Animals	Habitat	Controlled Habitat	Food	Cause of Failure	Remarks
Crickets	Common in grass and fields	Screened cage or jar, inch or two of damp sand	Bread, lettuce apples, meat scraps, dead insects	Cannibalistic	Provide a hiding place such as a board. Will live through the winter.
Grasshoppers	Common everywhere	Screened cage or meadow terrarium	Leaves, lettuce dipped in water	Parasites Lack of food and moisture	Will die in late fall after mating and laying eggs
Katydids	On bushes and trees	Same as grasshoppers	Same as grasshoppers		Will die in late fall
Praying Mantis	In tall grass	Screened meadow terrarium	Living insects Fresh liver	Lack of food	
Walking Sticks	In trees and bushes	Screened Meadow terrarium	Freshly sprouted grass	Lack of food	
Goldfish Minnows Guppies		Balanced aquarium, allowing 1" of fish to 1 gal. of water	Commercial fish food (Natural type)	Over-crowding	Remove excess food
Mice White rats Hamster Rabbit		Screened cage	Dry dog food	Drafts	Plenty of drinking water Field mice should be kept a day or two for observation and then released. Wild rabbits cannot be kept in captivity.

Animals	Habitat	Controlled Habitat	Food	Cause of Failure	Remarks
Guinea Pigs		Screened cage at 72° temperature. Straw on bottom	Dry dog food lettuce carrots	Drafts	Cage must be cleaned daily
Snakes	Woods and fields	Screened woodland terrarium	Earthworms Insects Bits of meat Frogs	Sudden change in temp. Lack of drinking water and humidity	Provide **hiding** space. Like warmth and sun. Skin dull before shedding. Need sticks to rub against when shedding.
Salamander Newts Efts	In or near brooks and streams	Semi-aquatic terrarium	Live insects Fruitflies Small earthworms Raw liver		Must **have living food or fed** by moving the food offered
Turtles	Ponds	Semi-aquatic terrarium	Ant eggs Bits of meat (raw beef) Earthworms Mealworms at will	Too low temp. Lack of means of getting out of water	Must not put in aquarium. Turtles like company: they do better if more than one in container.

AIR GRADE 3

Air is necessary to life on earth. A child is surrounded by air from the time he is born, yet he is scarcely aware of the existence of this vital substance. It is the purpose of this unit to develop science meanings which will help the child understand the importance of air to his existence; to acquaint him with some of the physical properties of air; and to describe some of the ordinary, everyday events in his environment which depend upon air.

CONCEPTS

Air is in some places that seem empty. (1)
Air is in soil. (2)
Air is in water. (3)
Air is in rocks. (4)
Air is in living things. (5)
AIR IS IN MANY PLACES.

Air moves things. (5-7)
Air lifts things. (8)
Air dries things. (9-10)
AIR WORKS FOR US.

Things that are filled with air cannot be filled with anything else unless the air can get out. (11-12)
Air can get into some things (13 to 15)
Air can be transferred from one thing to another. (16)
AIR TAKES UP SPACE.

Plants need air to live. (17)
Animals need air to live. (5)
ALL LIVING THINGS NEED AIR.

Wind is moving air. (18-19)
Wind causes clouds to move. (20)
MOVING AIR GIVES US CHANGES IN THE WEATHER.

Air contains different substances (21 to 24)
Air (oxygen) is necessary for things to burn. (25-26)
Air has weight. (27)
Air is lighter than water. (28)
Air exerts pressure. (29 to 34)
Air expands when heated. (35)
Air contracts when cooled. (35)
Hot air rises. (36)
AIR IS A REAL SUBSTANCE WITH DEFINITE PROPERTIES.

MATERIALS

Corks
Sand
Punk
Straws
Balloons
Metal cup
Small Candles
Rubber Stoppers
Medicine Dropper
Small fan (try fan from opaque projector or strip film projector,
Jars of various sizes
2½ gal. aquarium or deep pan
Cans (duplicating fluid gal. cans)
Milk bottles with large neck
Egg (small and hard boiled)

TEXTBOOKS Grade 3

1 - 3 : 86-92
1 - 4 : 87-105
1 - 5 : 174-175; 182-183
2 - 4 : 13-21; 92-103; 163-172
3 - 4 : 47-55
3 - 5 : 111-117

ACTIVITIES

1. Float a cork in a pan or dish of water. Take a jar of any kind that is "empty" and turn it upside down over the cork in the water.
2. Fill a jar about 3/4 full of dry soil and pour water into the jar. Look closely at the surface of the soil and the top of the water.
3. Fill a glass jar about ½ full of water and let it stand undisturbed for several hours. Look at the sides of the glass jar.
4. Fill a deep dish or pan with water and carefully drop several rocks into the water. (pumice, if available, is most effective.) Observe the surface of the rocks closely.
5. Discuss the need of man and animals for air. (oxygen)
6. Roll up a sheet of paper into a ball, blow it across the desk.
7. Make a small sailboat and sail it in a pan of water. Fan the boat,
8. Place a balloon under a book. Inflate it.
9. Wet two equal squares of blackboard. Fan one.
10. Wet two equal size cloths. Stretch one cloth on the floor or desk and hang the other cloth on a line.
11. Turn a jar full of air upside down in a pan of water.
12. Hold a medicine dropper by the glass without squeezing end and put the open end in water.
13. Put a little soapy water in a can or jar. Use a soda straw and blow some soap bubbles. Each bubble is air surrounded by water.
14. Fill a paper bag full of air and close the opening completely.
15. Blow up a balloon, an inner tube, or a ball bladder.
16. Fill a small glass jar with water by tilting it to one side in a pan of water. Call this "Jar A". When Jar A is completely full of water, stand it inverted on the bottom of the pan. Invert a similar glass jar full of air in the pan of water. (Jar B). Put the air out of Jar B into Jar A by raising Jar A above the edge of Jar B and tilting Jar B so that the air bubbles which leave it are beneath Jar A.

17. Spread some cold cream or other greasy material over one leaf of each of several plants.

18. Blow air into your hand.

19. If an electric fan can be obtained, it can be used to direct a stream of moving air. Waving sheets of paper or cardboard vigorously will approximate the same effect.

20. If possible, observe clouds on a windy day and a still day.

21. To see just how much dust is in the air in a room, pull down the shades; and using a strong flashlight or projector, direct a beam of light across the room.

22. Condense water vapor from the air by using a glass of ice water. Color the water to prove the glass does not "leak".

23. Discuss the fact that air is a mixture of gases. Oxygen, hydrogen, nitrogen, argon, etc.

24. Discuss pollen in the air at certain times of the year.

25. Put birthday candles in different sized jars, light the candles and cover the jars.

26. Light a piece of wood, let it burn for a few moments and then sprinkle sand on the burning wood.

27. Balance a yardstick. Tie a balloon on each side. Blow up one balloon. Let air out of the balloon. Reverse the process.

28. Invert a tumbler of air and submerge it in a container of water. Tip the tumbler to one side. The lighter air quickly rises to the surface.

29. Fill a tumbler to the brim with water. Put a card or piece of slick-surfaced paper over the mouth of the tumbler and turn it upside down.

30. Fill a soda bottle two-thirds full of water. Put straw in bottle and seal straw with clay. Try to drink the water. Try again without sealing the straw.

31. Fill a narrow-mouth bottle with water and turn it upside down to pour the water out.

32. Operate a simple siphon.

33. Put a yardstick on a table or desk. Let about four inches extend over the edge of the table. Open up large sheets of newspapers and lay them over the wood to the table's edge. Strike the wood that extends over the table.

34. Measure in inches the length and middle of your opened-up newspaper. Multiply these two figures together. Multiply this figure by fifteen (14.7) and you will have the approximate number of pounds of air pressure on the newspaper.

35. Put a small amount of water in a pyrex nursing bottle. Stretch a small balloon over the opening. Heat the bottle. Later place it in cold water. Repeat.

36. Measure the temperature of the air at different levels in your room.

FILMS

1. Air All About Us (Radnor Film Library)

FILMSTRIPS

1. The Air About Us. (SVE)
2. Our Ocean of Air (SVE)

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The Dryden Press, 195[illegible]
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MAGNETS

This unit on magnets is one that lends itself to learning through manipulation and experimentation. Throughout this unit emphasis is given to the use of magnets by man in his environment. The learnings established by the study of magnets will be developed in the following unit on electricity.

CONCEPTS

Magnets attract some objects. (1-2)
Magnets do not attract some objects (1-2)
Magnetism goes through some things. (3-4-5-6)
MAGNETS ATTRACT OBJECTS CONTAINING IRON AND STEEL.

A Magnet has two poles, north and south. (7-8-9)
The poles of a bar and a horsehoe magnet are near the end. (7)
Two unlike poles will attract each other (10-11-12-13)
Two like poles will repel each other. (10-11-12-13)
Magetism is a force. (14)
THE POLES OF A MAGNET ARE THE HOLDING PARTS.

When a magnetic needle is free to turn it will always point north. (15-16-18)
North and south directions can be shown on a compass. (15-16-18)
A COMPASS IS USEFUL FORFINDING OUR WAY.

Magnets can push as well as pull. (17-18)
Magnets can be used to make other magnets. (19)
Magnets that keep their magnetism are called permanent magnets. (21-2
Some tools are magnetized. (20)
MAGNETS ARE USED TO MAKE WORK EASIER.

Be careful not to drop or pound magnets. (22)
Store magnets with unlike poles together. (22)
Put keepers on magnets when not in use. (22)
MAGNETS LAST LONGER WITH PROPER CARE.

Electromagnets depend on electricity for their power (21-23)
Electromagnets can be turned on or off. (21-25)
There is an electromagnet in every electric motor. (26)
ELECTROMAGNETS HAVE POWER TO DO WORK.

MATERIALS

Lodestone
Labels
Empty can
Window glass
Nails
Piece of cork
Stiff paper
Soap
Piece of iron
Bar magnets
Two boxes
Thin wooden box
Jar
Dish
Needle
Shaker
Dry cell
Iron bolt
Horseshoe magnets
Scissors
Tacks
String
Iron filings
2 thin strips of wood
Wax
3 pieces of copper wire
Steel knitting needle

TEXTBOOKS

1 - 1 : 24-31
1 - 3 : 64-75
1 - 4 : 176-181
2 - 2 : 149-163

ACTIVITIES

1. Motivation: Encourage the children to manipulate the magnets so as to make whatever discoveries they can by themselves. Begin the class experience with magnets by letting various children show the class any important discoveries they have been able to make.

2. Make a chart listing the things magnets attract and do not attract. A variation of this would be to have the children label two boxes: "Things a magnet will attract," "Things a magnet will not attract." Have the children experiment with different objects and place them in the proper boxes.

3. Put a piece of paper between a magnet and a pair of scissors.

4. Place and empty can on the side of a thin wooden box. Put a magnet under the wooden side of the box and by means of the magnet make the can move.

5. Place tacks on a piece of window glass. Move a magnet on the underside of the glass.

6. Fill a jar with water. Place several tacks in the water. Suspend a magnet on a string and lower it into the jar.

7. Place a bar magnet into a long dish that contains nails or tacks. Note which part of the bar has little or no power to attract.

8. Try to obtain a lodestone (natural magnet). Locate its poles by placing the lodestone in a dish that contains small steel tacks or iron filings.

9. A lodestone could be suspended by a string so that it is free to swing around. Fasten the string to a support. The lodestone will always come to rest with one side pointing toward the magnetic pole. Lodestones can be used as compasses, as they were in ancient days.

10. Balance your magnet on a pencil. Hold one end of another magnet near one end of the balanced magnet. Try the other end of the balanced magnet.

11. Hang a magnet from a ruler by means of a string. Hold the north pole of another magnet near the north pole of the hanging magnet.

12. Hang a horsehoe magnet from a string. Use a bar magnet to find the north and the south poles of the horsehoe magnet. A variation of this is to have the children find the N and S poles of a horsehoe magnet by using the compass.

13. Cut a small piece of cork. Push a needle that has been magnetized (see activity 19) through a cork. Float the cork in a dish of water. Bring a bar magnet near the dish.

14. Lay two thin stripes of wood or two rulers on the table, about three or four inches apart. In the space between, put a bar magnet. Over the wood and the magnet lay a piece of stiff paper, glass, or thin cardboard. Hold a shaker of fine iron filings about three feet over the table. Sprinkle the filings evenly over the paper. Then tap the paper lightly with a pencil. The filings will arrange themselves in lines, called "lines of force."

15. Rub a needle with a magnet. Rub in only one direction. Cut a cardboard so that it is round, or use a milk bottle top. Write N, E, S, and W on the cardboard. Rub wax on the cardboard to keep it dry. Put some water in a dish. Put a little soap in the water. Lay the needle on the cardboard so that the point is at N. Put the cardboard on the water. This is like the first compass ever made.

16. Magnetize a large needle (see activity 19). Put a very small cork on each end of the needle. Float the needle and corks in a glass dish of water. Use a magnet to find the north - and south - pointing ends of the needle. The north-pointing end of the needle can be marked by painting the cork at that end.

17. Suspend a magnet by means of a string. By using another magnet show how a magnet can push as well as pull.

18. Make a needle into a magnet. Push the needle into a thin piece of wood. Place the wood on water. Hold one end of the magnet near the top of the needle. Then try the other end of the magnet.

19. Stroke the pointed end of a needle with a magnet. Stroke from the middle of the needle toward the point. Always stroke from left to right. Use this to pick up other needles.

20. Through discussion have the children list many practical uses of the magnet that they have seen in homes or at work.

21. Connect the ends of a bare wire to the terminals of a dry cell and try to pick up the iron filings. For this activity leave the wire connected to the dry cell for as short a period as possible. The dry cell runs down quickly with most experiments on electromagnetism.
You will note that the iron filings are attracted to the copper wire as long as the electricity is flowing. As soon as the wire is disconnect from one of the terminals, most of the iron filings drop off.
The activity illustrates the point that a magnetic field surrounds a current-carrying wire.

22. Illustrate the proper care of magnets by listing the rules for the care of magnets and drawing illustrations for each rule.

23. Electricity flowing through a wire around a piece of iron makes the iron a magnet. Wind an electrical wire around a three or four-inch iron bolt. Wind the wire as many times as possible. Fasten the ends of the wire to the posts of a dry cell. Touch nails or tacks with the end of the bolt.

24. Using the same equipment as in activity 23 and adding a switch, the current can be turned off and on. To make a switch fasten just one end of the wire to the dry cell. Fasten the other end to a small piece of wood by means of a thumb tack. Fasten a third small wire to the other binding post of the dry cell and also to a thumb tack on the piece of wood. The electromagnet can be turned off or on by completing or breaking the circuit.

25. Using equipment in activity 23, put in the coil of wire of steel knitting needle in place of iron bolt. Allow it to remain there for a few seconds. Remove it and use as a permanent magnet. A piece of hard steel will retain its magnetism but soft iron will lose its magnetism. Commercial permanent magnets are made in this way. Electricity is used in place of the dry cell when they are made commercially.

26. Have the children bring in pictures that show the practical use of the electromagnet. Refer to Gateway film on magnets.

27. Discuss electric refrigerators, vacuum cleaners, freezers, etc.

RESOURCES

1. Electrical engineer   2. Scientist

FILMS

Electric Magnets - Radnor Film Library
Magnets - Gateway Productions Inc., 1859 Powell Street, San Francisco 11, California
Magnets - Young American Film, 18 East 41st. N.Y. 17, N.Y.

FILMSTRIPS

Electric Magnets (SVE)
Magnetism and Electricity "
Magnets (Encyclopedia Britanica Filmstrips)
Magnets (Young America Films and Filmstrips)
Electromagnets " " " " "

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ELECTRICITY

Electricity is one of the great sources of energy in the world. It is a physical force which man has learned to use to improve his way of living. the purposes of this unit are to help children understand the way electricity works, how it travels, how it is useful in everyday life, and how it can be used safely.

CONCEPTS

Static electricity can be made by rubbing one object with another (1-2-3-4)
Some things hold static electricity (5-6-7-8)
ELECTRICITY AT REST IS STATIC ELECTRICITY

Electricity needs a complete pathway in order to move (9-10)
A dry cell, wires, and a light bulb can make a complete pathway for electricity (9-10)
ELECTRICITY IN MOTION IS CURRENT ELECTRICITY

Substances which make good pathways for current electricity are known as conductors. (12-13)
Substances which make poor pathways (and may even slow down the motio of current electricity to the point of stopping it altogether) are known as non-conductors or insulators. (12-13)
SUBSTANCES ARE CONDUCTORS OR NON-CONDUCTORS.

Electricity flows through wires. (14)
In many places there are electricial wires over the street (14-15-16)
In other places the electrical wires are in the ground (14-16)
Electricity does many things to help us in our community. (15-16-17-18-19)
Electricity does many things to help us in our homes. (16-17-18-19)
ELECTRICITY IS USED EVERYDAY IN MANY WAYS

A motor is a device used to change electricity to motion. (20)
Motors need electricity to make them run. (20-21)
Many electrical appliances are run by motors. (21)
ELECTRICITY HELPS TO MAKE WORK EASIER.

Electric current is poweful and can produce dangerous shocks. (22)
The flow of electricity along a pathway or circuit can be stopped and started by means of a switch. (23-24-25)
A switch is a safety device to control the flow of electricity in a circuit. (24-25)
An insulator is a safety device used to keep electricity from going where it is not wanted. (24-26-27)
It is safe to work with dry cells because they produce only a little electricity. (26)
Safety rules should be followed when using electricity. (28)
THE SAFE USE OF ELECTRIC IS IMPORTANT.

MATERIALS

- Oatmeal box top
- Snap fastener
- Bell wire
- Small piece of wool
- Floating bathtub toy
- Electric bell
- Large nail or screw
- Small piece of fur
- Tissue paper
- Small switch
- Copper wire
- Light bulb
- Small sewing needle
- Small piece of silk
- Typewriter paper
- Clear plastic box with l
- Spool (small)
- Dry cell - String

TEXTBOOKS

1 - 2 : 121; 126-127; 130-131
1 - 3 : 76-85
1 - 4 : 164-183
2 - 3 : 264-279
2 - 4 : 249-257

ACTIVITIES

1. Motivation: Discuss with the children some evidences of static electricity snapping of one's hair when it is brushed or combed; shock that one receives when touching a metal object after scuffing across a carpet; the way clothes cling to one's body in dry and often cold weather; sparking of a cat's fur in the dark; the separating of a nylon article of clothing from a woolen one.

2. Float a bathtub toy in a shallow pan of water. Hold a hard rubber comb near the floating toy. Rub the comb with a wool cloth and hold it near t the toy. Watch the toy move.

3. Place a long strip of paper on the table and brush it rapidly with a piece of wool or fur. Fold the paper in half and place it over a ruler so that the fold rests on the ruler. Rub a hard rubber comb with wool. Hold the comb in a vertical position between the lower ends of the paper.

4. Suspend a hard rubber comb by means of a thread. Hold your finger near the comb. Observe what happens. Rub the comb with a wool cloth and hold your finger near it. Watch the comb move.

5. From tissue paper cut a string of paper dolls. Make the dolls about an inch high. Stand the dolls up in a plastic box and put on the lid. Rub the lid with your hand or piece of wool or fur. The dolls will dance up and down.

6. Hold a sheet of paper against the chalkboard. Rub it with a piece of fur or wool. Rub it until it stays on the chalk board without holding it

7. Cut tissue paper into small pieces about ¼ inch square. Rub a hard rubber comb with a piece of fur or wool. Hold it near the bits of tissue. It will attract them. After a few moments the bits of paper will begin jumping off the comb. Do the same experiment rubbing the comb with silk.

8. Cut a fringe along one side of the sheet of typewriter paper. The strips in the fringe should be about ½ inch wide and 3 inches long. Hold the paper, with the fringe down, against the chalkboard. Stroke the paper, using down strokes, with the fur or wool. Lift the paper away from the wall. Watch the fringe.

9. For this activity you will need a dry cell, two pieces of copper wire, and a bell or light bulb. Scrape the covering off all ends of the wires. Fasten one end of one of the wires to the binding post of the dry cell and fasten the other end of the same wire to the bell. Do the same with the second piece of wire using the other binding post of the dry cell and the remaining post of the bell.

10. Several groups of children each with a dry cell, wire, and an electric bell make a complete circuit. When the circuit is complete. the bell or light bulb will ring(or Light). One of the groups may disconnect the wire from the battery. Cut the wire, then attach it to the battery to show that the bell does not ring when the circuit is broken. Suggest that they put a switch into the circuit. (Refer to activity 25 in the unit on Magnetism to show how to fasten the switch.)

11. Have the children make a large picture to show how electricity travels with a dry cell, wires, and a light bulb.

12. The activity should be used with caution stressing safety rules to be followed, stressing the importance of using only current from a dry cell.
Make a complete pathway for electricity with a dry cell, wires, and a light bulb. Cut the wire as if to put a switch in the pathway. Put different things across the break in the path. Try such things as scissors, string, a paper clip, or anything else you wish. When the pathway is complete, the bulb will light.

13. Make two lists showing good conductors in one and poor conductors in the other. Here is a suggested list: cloth, glass, plastic, rubber, straw, copper, silver, feathers, brass, wood, aluminum, silk.

14. Ask the children to find out , if they can, how electricity is brought to their homes and to school. See if the wires can be seen coming into the building.

15. Have each child draw a picture of one object that uses electricity that he might see out of doors on his way to school.

16. Make a mural to show wires coming into building above the ground and in the ground. Use the cross-section idea to ellustrate this.

17. Invite someone whose livelihood depends on the use of electricity in some form to come to the class and explain how he makes use of it.

18. Write a story telling what living in your house would be like if the electricity were cut off for several days. how many things would have to be done differently?

19. Make a bulletin-board display of pictures drawn by the children showing different ways we use electricity in daily living.

20. Put a small needle in the eraser of a pencil then put the pencil in the spool. Make a tiny hole in the middle of the box top. Put the head of one part of the snap fastener into this hole, from underneath. Then snap the other part over the tiny head. Put four clips on the rim of the box top equal distances apart. Then place the boxtop with the fastener on the needle. Make an electromagnet using a dry cell. (See experiment number 23 in the unit on Magnetism) Hold the nail of the electromagnet near one of the paper clips. Watch the box top begin to spin.

21. Make a chart showing two separate groups of electrical appliances; "Those run by motors", "Those not run by motors."

22. Make a list of safety rules to show the safe use of electricity in the home.

23. Write a list of all the switches you use in your home. Find out how many switches Mother uses.

24. Ask the school custodian to show pupils where electricity enters the school, the switches, how insulating materials are used for safety.

25. Make large pictures of some of the things that you turn on with a switch.

26. After completing activity number 9, explain to the children that scraping off the wire is really removing the insulation. As a safety precaution have a child wrap only the exposed part of the wire that leads to the binding posts with black electrical tape.

27. To join two wires the insulation must be removed to expose the bare metal ends which are to be joined. These bare ends are then joined by twisting them around each other. Cover the bare wires by wrapping with insulating material (electrical tape).

28. Have the children make a list of safety rules to be followed when working with and when using electricity.

29. Culminating Sometimes we forget that the use of electricity has changed our ways of living. Make a chart showing ways of living before electricity and now (present time).

RESOURCES

1. Franklin Institute, 20 and Parkway, Phila. Pa. Call: Lo 4-2600, ext. 202. Contact Mrs. Easton, Education office. 15¢ per pupil. Contact two weeks in advance. Closed Mondays. Guides and lunchroom facilities provided.

2. W C A U - City Line and Monument Avenues, Phila., Pa. Call GR 7-8300 Contact Miss Margaret Kearney, Educational Director. Guide provided for tour. Two weeks advance notice advisable.

3. W N A R, Old Arch Road, Norristown, Pa. Call: BR 2-7600

4. Local electrical shop

RESOURCE PEOPLE

1. Local doctor(parent)
2. Electrical Contractor
3. Electrical Engine
4. Electric-appliance dealer
5. Amateur operator
6. Western Union represetative
7. School Custodian

FILMS

Flow of Electricity - Radnor Film Library
Making of Electricity -

Mr. Bell - Bell System Telephone Offices (through local Bell Telephone off. (order 1 month in advance)
Magic for Mrs. Smith - Bell System Telephone Offices " " "
Electricity - Gateway Film Productions, 1859 Powell Street, San Francisco 11, California

FILMSTRIPS

Electricity - Row, Peterson
Electricity Does It for Us - Popular Science Pub. Co., Audio Division, 353 Fourth Ave., New York 10, N.Y.
Wonder of Electrictiy - Eye Gate House Inc. 2716 41st Ave, Long Island City 1, N.Y.
Frictional Electricity - Young America Filmstrips, 18 E. 41st St. N.Y. 17
Electricity - " " " N.Y.
Magnetism and Electricity - SVE
Electricity (color) - Encyclopedia Britannica Filmstrips

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LOWER MERION SCHOOL DISTRICT GRADE 3

A SOUND MIND IN A SOUND BODY

This unit for grade three, A Sound Mind In A Sound Body shows the relationship between bodily health and mental health. The child should learn that one is dependant upon the other. The child should learn that fears and anger are natural and that they can be mastered by understanding them. Mastering our emotions can improve our personality and help us to lead happier and healthier lives.

CONCEPTS

Everyone is afraid sometimes. (1*)
Some fears are reasonable, some are not. (2-3*)
Different people show their fears in different ways. (3*)
Sometimes people can lose fears by talking about them. (4-5-6-7-8-9)
IT IS IMPORTANT TO LEARN ABOUT FEARS.

Everyone gets angry sometimes. (10-11)
We show anger in many different ways. (12*-13)
Temper is "learned," not inherited. (14*).
Everyone must learn to control his feelings of anger. (15*)
IT IS IMPORTANT TO LEARN ABOUT ANGER.

Personality includes how one feels about things and acts toward others. (16*-17)
Everyone needs to feel good about himself. (18*)
There are constructive ways we can satisfy needs for friendliness and status. (19*-20)
People who are insecure are most likely to be prejuidced. (21*-22-23-24-25-26)
IT IS IMPORTANT TO LEARN ABOUT OURSELVES.

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*These numbers refer to items under Activities and Data that provide facts for the teaching of the concept.

ACTIVITIES AND DATA

1.* Fear is a natural emotion; everyone feels afraid sometime or other. A person who claims to be afraid of nothing would be a foolhardy person. A foolhardy person would take risks that could injure or even kill him. A really courageous person knows what to fear and tries to overcome it.

Jerold Bein's book called Laugh and Cry, Your Emotions and How They Work (Morrow) might be read to children. In this book the author explains that emotions such as anger, fear, jealousy, sadness, and excitement are all quite natural. But we do have to learn how to handle our feelings.

2. Fear can help to protect us--we do not put our fingers into light sockets or play with the tubes in the back of the television set. We are afraid that if we do, we might be injured seriously. This fear of being hurt makes us careful when we cross streets, makes us careful about our eyes when we handle sharp tools. Fear here is nothing to be ashamed of because the fear of danger helps to keep us safe. Have the children name other examples of reasonable fears.

3.* We are afraid of disease so we are careful in keeping our hands clean, keeping dirty objects out of our mouths, and eating clean food. This is a reasonable fear and aids in keeping us healthy. A person can be so afraid of disease, however, that he is always washing his hands, will not shake hands with other people, and is always thinking about germs. This fear of disease can be carried to unhealthy extremes; a fear of disease that is carried this far may cause a person to have a loss of appetite that will bring on malnutrition. Malnutrition brings on general body weakness and leaves a person unprepared against diseases. The very thing feared can be brought about by the fear.

Most of us have a fear of drowning. This fear makes us go swimming with a buddy, swim in safe areas, and only going to swim after food we have eaten has had time to digest. This is a reasonable fear and precautions that we take safeguard us against possible danger. Another person might be so afraid of drowning that he refuses to go in swimming at all. Is this a reasonable fear?

4. Ask different children to act out one of their fears in front of the classroom. (Or some fear they know about.) See is the class can guess each fear that is acted out by sociodrama. Sociodrama is a living through of experiences of common concern to the group. These dramas aid in getting the children to realize that they face the same problems in life, that they can understand the problems, and that these problems can be solved. Be sure that the fears depicted are not ones that cause pupils to develope harmful fears.

The children who will work together to do these sociodramas may be brought together by sociometric techniques. When an individual is with others who respond to him and with whom he wants to be, he has greater emotional security. The children may be told to put their choices on a piece of paper and to put a "1" next to their first choice, a "2" next to their second choice, etc. Explain to the children that their choices will be kept confidential.

5. The teacher can encourage frankness in the children to talk about their fears if he freely discusses the fears he had as a child and which experience and maturity showed to be ungrounded and needless. Stress that we do not fear what we can see or what we can understand nearly so much as we fear the things we do not see or that we do not understand.

   We have all feared tests, physical examinations, or operations. The fear that we felt in anticipating these things, our imaginations at work imagining all sorts of dreadful possibilities, were much more horrible than the tests when we actually took them, the physical examinations was much less frightening when we experienced it, and the operation less painful and dreadful than we had imagined it. After we do something we have dreaded, our "stage-fright" of it decreases.

6. Sometimes people can lose fears by talking about them with a friend or parents. When you talk about fears, you learn that other people have fears, too. "Swapping" fears this way helps you learn that you are not the only person that is afraid. Drawing pictures is another way of swapping fears. Draw a picture of something you are afraid of. (Keep the drawings anonymous for better results.) Each of your classmates should draw a picture, too. Then hang up all the pictures and have each person guess what the picture shows.

7. Children of this age group are afraid of storms, deep water, darkness, snakes, doctors, and dogs. They are afraid that people will find fault with them or that other people do not like them. Talking over how all people, not only children, have apprehensions can help them understand and overcome their fears. Our fear is not so formidible when we can discuss it. Discussing it helps us to understand our fear. Understanding our fear can help us to overcome it.

8. A boy is afraid of meeting new people. Have a few children act out this fear. Then make suggestions about how the boy might lose his fear of meeting new people. Have some of the children act out the suggestions.

9. Discuss some fears with the youngsters that seem to change as they grow older. Fear of the dark could be one example. Can the children think of others?

   Discuss this. Have some people done unpleasant things to you to try to make you get over a feeling of fear? What were they? Did they work?

   Here are some examples of "Shock" techniques in curing fears. A child might have a fear of water which makes it difficult for him to learn to swim. Some people think it is a good practice to throw the child into the water over his head. This usually results in a greater fear of the water; this technique almost guarantees that the child will remain a non-swimmer.

   A child is afraid of the dark and is used to sleeping with a light on. His father turns off the light, forces the child to sleep in t the darkness, and threatens to beat the child if he cries. The result of this is that two fears replace one--there is a greater fear of the darkness and an added fear of being spanked.

10. We have all experienced anger. We have been angry at ourselves, at other people, and at things. We have been angry at ourselves when we did something that we knew to be wrong, that was forbidden by our parents, when we have forgotten to do something that was important. We have been angry at our parents, our brothers and sisters, teachers, when they have not permitted us to do the things we wished to do. We have all been angry at things. Who has not carelessly walked into a wall, got angry at it, and kicked at it?

Have the children discuss when they have been angry at themselves, when they have been angry at others, and when they have been angry at things. Sometimes we get angry at others even though our feelings have not been hurt. What are some of the things that boys and girls do that make other children angry?

11. There are many things that you can make plays about. Here are some of the things that we can act out:

A. One child always says other children's work is no good.
B. A child breaks another child's thing by mistake.
C. A child pushes another child at the fountain.
D. One child always pushes his way into the line.
E. Some children always play games against one child.
F. Two children are always whispering secrets to each other.

Can you remember things like these that happened to you and your friends? Make the play as it really happened. Then see if you can change the play so it comes out better for everyone. When you act out some of these stories, you will learn better ways of doing things that are better for you and your friends.

12.* We show anger in many different ways. Ask the children how they react when they are angyy? How do their brothers and sisters react when they are angry?

We act differently in our anger when we get older. It is normal for a small child to have a "temper tantrum" when he is angry; the child will cry, kick, hit, bite, and throw himself upon the floor. Why isn't this normal behavior for children in the third grade? If we behave in this way when we are angry, it shows that we are not getting to be mature persons.

Some children have found that if they sulk long enough, they will be able to get their way. Others will act contrary when they are angry. Do not some of us feel that if we get angry enough, others may let us do what we wish to do?

13. Make a picture story of a fight that you know about. Show what really happened in the fight. Now make another picture story with a better ending. In which picture do you have to start making changes? Is it near the beginning of your story or near the end? You can make your picture story large enough for the bulletin board, you can make a book of class picture stories or you can make the picture story into a roll movie. (Paste the pictures together so that they can be rolled up. They can be shown in a cardboard movie house.)

We might learn a great deal about anger by keeping a record of the fights that happen. Let's copy some of the things we want to know about a fight on the chalkboard.

A. What started the fight?
B. What was said or done that kept the fight going?
C. How did the fight turn out?
D. Who was better off because of the fight?
E. What might have been done or said to keep the fight from starting or growing worse?

14.* We "learn" to have a temper; we do not inherit it from our fathers or mothers. We can inherit the color of our mother's eyes or our father's height. We cannot change our eye color or what height we will be but we can learn to control our temper. Temper is something that we develop ourselves; it cannot be inherited. Why is it wrong, then, for a person to say, "Johnny is acting like his father; he has his father's temper."
We sometimes hear it said that certain nationalities are born with tempers. Why is this statement incorrect?

15.* We can learn to control our feelings of anger just as we can control and overcome our feelings of fear. If we know what makes us angry, we can avoid those situtions by avoiding them or by learning to understand our feelings of anger. Anger is a feeling that is inside of us and any feeling can be changed.

Jealousy is a mixture of both fear and anger. We get jealous of a brother or sister because it seems our parents like him or her better. We fear that by loving our siblings, our parents must therefore love us. We are angry at our siblings because we feel they are the cause of this.

Are you jealous of a baby brother or sister? Why does the new baby get all the attention in the family that it does? Can the baby take care of itself as well as you can? If we grow up emotionally and learn to look at things as they really are, we can control our fears and anger.

16.* Personality has the word person in it but it means much more than that. It is the sum total of everything that makes us uniquely what we are. It is more than our looks, our appearance, our manners, the impression we make on others. It is something that we can improve--we can change our feelings about people and the way we act toward others. Can we say that, "His personality has improved?" (Caution: do not force the children to memorize the meaning of personality.)

17. How would we begin to describe someone? Let some of the children describe a friend at this time. They will probably give a good physical discription of their friend. Ask, "Does this tell what your friend is really like? Shouldn't you tell what kind of a person he is? How does he act toward others? How does he think about other poeple? Is he a happy person?" When these other aspects are added to the physical description of our friend, we will begin to get the essence of personality.
Emphasize that just as each of us look different, each of us has a different personality. Each of us has different feelings about different things. Each of us is embarassed at times, afraid at times unhappy at times, jealous at times. But each of us get these feeling for different reasons.

18.* Everyone has good qualities and bad qualities. No person has all good qualities; no person has all bad qualities. We, the teacher, our parents, you, your classmates seem to be a mixture of both good and bad qualities. You may not be able to run as fast as Janie or throw as far as she does but there are things that you do well and Janie cannot do as well.
Each of us is a unique person. Just think that in all the world there is not another person like you.

If we do not like ourselves, this can cause us to feel inferior toward other people. It is not healthy to feel inferior because this feeling can make us mentally ill in the future. We must be aware of our good qualities.
There are things that we can do to improve ourselves. We can be friendlier toward others. We can be kinder to other people. We can learn self-control. We can study harder. In improving ourselves, we can improve our personality.

19.* Scientists tell us that people in groups can be very useful in helping people to get along with others. You can help. If you know someone who acts in some unpleasant ways, there are several things that you can do to help this person. We must remember there is always a reason for the way that people behave. You can try to be friendly toward a friendless person. You can occasionally walk home from school with him. You can be sure to say a friendly, "Hi," to him each day. You can say, "Here catch," when you have a baseball. You can choose him for a team. You can give honest compliments to such a person.

20. Discuss with the children the attention getting devices that some will use to get attention, such as creating classroom disturbances or treating the others to candy, etc. We must try to help people who behave in this way; we must understand that they have problems. If we understand this, we will be acting in a constructive way toward them.

21.* Having unfair opinions or feelings against a person or a group of persons is called "prejudice." Notice it has the word "judge" in it and the prefix "pre" which means before. We must not judge other people before we have any knowledge of them. In other words, we must not draw conclusions and judge others without thinking; we must not condemn a person or a group of persons without a trial. This is not the American way of doing things.

22. Sometimes people get into the habit of blaming other groups of people for their own troubles. Did you ever hear people say things like, "If those new kids didn't take so much of the teacher's time, I'd do better," or "If the rest of the team had tried as hard as I did, we would have won the game."

23. Fear of strange things, such as strange foods, new jobs, a new neighbor, makes many people behave in prejudiced ways. Understanding this will help you to understand the behavior of other people in groups. You can try to be a fair and unprejuidced person.

    Tell the children stories about great people, such as George Washington Carver, members of supposedly "inferior" groups.

24. Suggested topics for class discussion.
    1. How would you act if you were offered a food you never saw before?
    2. If a person you don't know calls, "Hey there!"
       a. Would you stop and say, "Hi - what do you want?"
       b. Would you feel afraid, stop, and say, "You calling me?"
       c. Would you run away?
       Think about your reasons for responding in the way you did. Were the reasons based on fact, or were you prejudiced by fear of the unknown?

25. Which of these statements do you think are true? Which statements do you think are prejudiced statements? Which could you test for yourself? How could you test them?
    a. Billy Brown isn't a "good guy" because he doesn't belong to the Cub Scouts.
    b. Children whose sandwiches are wrapped in bread wrappers are usually children who aren't very nice.
    c. Children with fair skin sunburn more easily than those with dark skin.
    d. People with red hair have terrible tempers.
    e. Children who wear glasses are sissies.
    f. Measles are catching.
    g. You can't trust people with crossed eyes.

26. Try something new this week and report to your class about it. You could choose one of the following or use an idea of your own.
    a. Make a new friend. Invite someone to your house, or to do something with you, whom you have never invited before.
    b. Eat a new food.
    c. See a new television show.
    d. Play a new game.

    We may dislike some of the above. If we do, we should have reasons for our dislike. On the other hand, we might find, to our surprise, that we like these new things.

GRADE 3

FILMS

Don't Be Afraid 332	Phila. Suburban Film Library
Don't Get Angry 333	" " " "
Manners in Public 886.03	" " " "
Other Fellow's Feeling 1032	" " " "

FILMSTRIPS

Jim's Family 228-1	Society for Visual Ed., Inc.
A Day at School 228-2	" " " "
Learning to be Forgiving F801-3	" " " "
Learning to be Unselfish F801-4	" " " "

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Lancaster, Pa. Pamphlets such as, "Anxiety in Children," "Jealous Feelings," "Nervous Habits," "The Unhappy Child." These are only a few of the long list of excellent pamphlets. (Free)

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ELEMENTARY SCIENCE REVISION - 1962

EVALUATING THE UNITS

FOURTH GRADE

Gerald Craig wrote, "Evaluation should be thought of as an integral part of teaching, rather as something to be set aside to do at a special time, such as a test at the end of a period of instruction. As a teacher works, she can study the children to determine the effect of the learning upon them. ...Frequently forms of oral reporting on observations should be utilized. It should be kept in mind that some children will be superior to others in oral expression in science. Written work may be used as a means of evaluating children. However, teachers should be on the alert to avoid destroying interest in science by excessive use of notebooks and other forms of written work."[1]

In the fourth grade our study of Living Things , ("Plants ") Non-Living Things ("Earth's Rocky Crust") ("Water") ("Our Solar System") and Energy ("Machines") continues and is broadened. It is at this point that our children first receive letter marks in science. Care should be taken to distinguish between verbal facility and rote memory and a real interest and ability in science.

The fourth grade evaluation sheets show that "Earth's Rocky Crust," "Plants," "Machines," and "Our Solar System" were enthusiastically received. "Water," though generally well received, was thought by some teachers to be a less well-rounded study than the others. Originally the plan called for "Air" in third grade, "Water" in fourth grade,and "Weather" as a culminating unit in fifth grade. Apparantly this is all right in the over all picture, but is rather artificial in practice. It might help to keep "Water" a short unit, and also to concentrate on the fact that it is almost completely activity centered and requires little or no use of textbooks. A short respite of this kind might be welcome to all.

Additional suggestions that were made concerning the units appear on the next page.

The new health unit "Safety and First-Aid" is also included.

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[1] Science For Today's Children, Ginn, 1958, Pg. 867.

Additional Suggestions for Teaching the Units

EARTH'S ROCKY CRUST

Since trained geologists often cannot identify rock specimens without making detailed tests, teachers should not feel that they must identify every rock brought to class. Whether it is probably sedimentary, igneous, or metamorphic and why you think it is so should often be sufficient.

WATER

Suggested activity 35 can be developed further by digging a well in the aquarium. Fill an aquarium three-quarters full of sand. Pour in water until the water table is two inches or so below the sand. Dig the well. Cut the top and bottom from a small frozen juice can. Work the can into the sand.

PLANTS

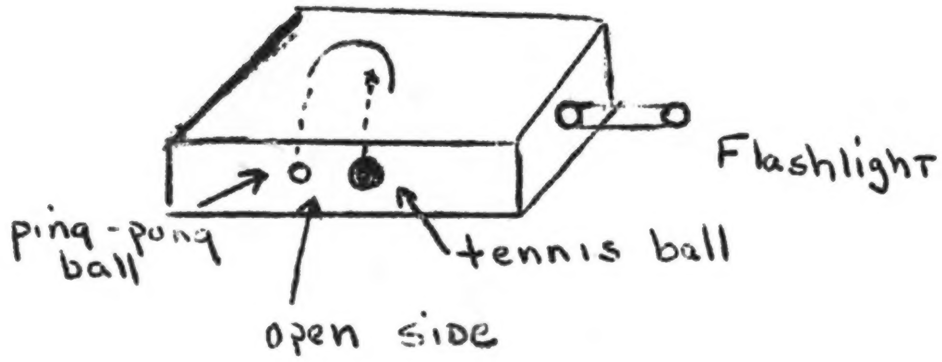
The bioscope can also be used to view lima bean skin, pollen grains, ovules in pistil, a piece of grass and its seed, and soil from plants.

MACHINES

Childcraft, Volume 9, is an excellent source of ideas and information for this unit.

OUR SOLAR SYSTEM

To illustrate solar and lunar eclipses:



LOWER MERION SCHOOL DISTRICT Grade 4

EARTH'S ROCKY CRUST

This unit provides opportunity to acquaint the child with the physical features of the earth on which he lives. Its study, dovetailing with that of the solar system, widens his horizon on the vastness and the content of the world about him so that, from his position in the present, he may grow increasingly aware of his relationship to the past and to the future.

Included in the objectives may be the blending of facts relative to the earth's composition and to the forces constantly at work changing its surface. Accompanied by the study of scientific methods used in deducting earth's history, the study of theories about its formation should invite the child's curiosity.

CONCEPTS

Earth, calculated to be 8,000 miles from North to South Pole, has a core of liquid rock. (4-6-15)
Intermediate layers separate the core from the crust, which is estimated to be 30 miles thick. (4-6-15)
Earth's temperature grows hotter toward the center. (16)
EARTH IS MADE UP OF DIFFERENT LAYERS.

Earth's crust is a mixture of soil, rock, air, and water. (11-49-50)
Rocks vary in the way they are formed. (15-6-1-10-12)
Rocks cooled after great heat are called "Igneous". (17-1-10)
Rocks pressed hard as they settle under water are termed "Sedimentary". (17-12-1-10)
Igneous or sedimentary rocks that have undergone change are called "Metamorphic". (17-1-10)
EARTH'S CRUST IS COMPOSED OF ROCKS OF MANY VARIETIES.

Minerals are a part of earth's rocky crust. (1-10)
Mineral forms vary; e.g., gas, petroleum, coal, metals. (40)
Mineral formation is a process covering a long period of time. (41-9-12)
Plants absorb minerals from the soil. (45-44)
Animals depend on plants for their food. (31)
Man's body contains minerals needing replacement for health. (46)
Man uses minerals for many purposes; e.g., fuel, lubrication, construction. (43)
Minerals may be depleted, are irreplacable. (20-42)
MAN MUST USE MINERALS WISELY TO PRESERVE THEM FOR FUTURE USE.

Earth was formed long ago over a period of many years. (20)
Rock study gives scientists clues to earth's great age. (5-7)
Earth's surface changes to form mountains, valleys, water bodies. ([illegible]-14-13)
There are new and older mountain ranges on earth's surface. (20)
Volcanoes, earthquakes form mountains. (16-2)
Earth's crust may shift in folds. (2-13-3)
It also may rise and sink in blocks. (14-2)
Geysers, hot springs, let inner heat escape. ([illegible])
FORCES WORK IN EARTH, RAISING AND LOWERING ITS SURFACE.

Wind, water, sun affect changes in earth surface. (18)
Top soil washes, blows away. (18)
Erosion creates some deserts. (38-7-18)
Soil builds up in new places. (29)
Frost, snow, ice, change earth's texture. (18)
Oceans change earth's shorelines. (21-29)
Glaciers change earth's contours. (30)
EROSION AND WEATHERING CHANGE EARTH'S SURFACE.

Rocks break into smaller pieces to become the basis of soil. (18)
Chemical changes from living things help break up rock. (19)
Oxidation of rock by air occurs. (18)
Water decomposes rock; e.g., caves. (15-23-22-18-7)
Gravity pulls rocks down as they break. (18)
Plant roots help rock disintegration. (19)
Oceans change beach composition. (23)
MANY FORCES BREAK ROCK DOWN TO SOIL.

Soil contains decayed plant life; e.g., humus. (33-51)
Soil contains decayed animal life. (51-33)
Soil's texture depends on amount and size of rock, clay, sand, gravel, Silt content. (25-49)
DIFFERENT KINDS OF MATERIALS FORM TOP SOIL.

Plants need top soil for growth. (24)
Living things need top soil for food and homes. (33-31)
The nature of top soil determines the health of all living things.(24-31-33)
Erosion can damage community life. (6-29)
Grasslands hold soil for our use. (34)
Forests hold soil for our use. (35-34)
Windbreaks and shelter belts hold soil, invite animal living. (35)
SOIL IS A COMMUNITY RESOURCE THAT MUST BE GUARDED FOR USE.

Top soil builds up veryslowly. (18-36-29)
Some plants enrich soil; e.g., alfalfa, clover. (37)
Some plants deplete soil; e.g., corn, cotton. (37)
Animals enrich soil; e.g., worms, decaying bodies. (33)
Overgrazing, permitted by man, is a cause of erosion. (37-38)
We can improve soil by adding to it; e.g., fertilizers. (39)
We can improve soil by utilizing nitrogen-producing plants,i.e., crop rotation. (37)
We can improve soil by utilizing a variety of planting methods, i.e., strip cropping, contour plowing, terracing. (48-37)
Plants, animals, and human beings depend on soil for their lives.(31-33)
LIVING THINGS DEPEND UPON MAN'S INTELLIGENT USE OF THE SOIL.

Scientists study the rocks in earth's layers. (47-1-[illegible])
Scientists study fossils in earth's layers. (28-27-25)
Scientists study the Ice Ages. (29-30-32)
Scientists study soil and its preservation. (48)
Scientists arrange time tables showing earth's development. (32-6)
SCIENTISTS LEARN ABOUT THE HISTORY OF OUR EARTH.

MATERIALS

- Pictures; e.g., seismograph
- Ammonium bichromate
- Sea shells (expendable)
- Trowel or shovel
- Glass jar and cap
- Plant fertilizer
- Hydroponic materials
- Hydrochloric acid
- Magnifying glass
- Iron filings
- Plaster of Paris
- Fork
- Fossils
- Samples of coal, iron ore, petroleum, etc.
- Modeling clay
- Limewater
- 2 glass tubes, cheesecloth
- Pocket knive
- Trimming shears
- Rock collection, including meteor, for comparison purposes

TEXTBOOKS

1 - 3 : 47-63; 98-115
1 - 4 : 78-85; 210-254
1 - 5 : 180-201
1 - 6 : 165-187
2 - 3 : 1-17: 39-67; 100-130
2 - 5 : 161-211
2 - 6 : 213-227; 239-246
3 - 3 : 2-21; 39-58
3 - 4 : 47-62
3 - 5 : 38-43
3 - 6 : 61-93

ACTIVITIES

1. Exhibition of rock collections, drawing upon immediate environment, could introduce and motivate this unit study. Meteoric rock samples are part of earth's composition, too. Compare children's samples with those in basic collection. Scratch rocks for degrees of density.

2. Discuss a seismograph (picture) as an instrument recording earth's tremors. Bring in timely news articles about earth's disturbances.

3. Experience vibration by letting a child hold fork handle while another child strikes the prongs sharply.

4. Children construct a globe demonstrating earth's topography through different colors or in three dimensions. A cross-section depicting layers in proportion (core 2000, intermediate layers 2000, crust 30-40 miles) from center to surface should also be constructed.

5. Visit a pit dug for a new building, a quarry, a railroad or a highway cut to discover earth's layers.

6. Draw pictures, murals.

7. A talk or a paper written by a child who has traveled to some places perhaps famous for its geologic display; e.g. Grand Canyon can personalize the subject.

8. Read stories or reference material tracing the history of the school area. (See The Story of Montgomery County)

9. Write for information to the State Dept. of Geology for materials. Construct 16½ foot geologic time line, showing first half consumed before life appeared. Dinosaurs arrive 6 inches from top, man in last 1/10 inch. Scale 10,000,000 years to 1 inch.

10. Examine materials (rocks and soil) under magnifying glass.

11. To demonstrate the presence of air in soil and in rocks, pour water on dry substances and note escaping air bubbles.

12. To illustrate growing pressure under earth's surface, have child lie down and place an increasing number of books atop him.

13. To show lateral pressures on earth's surface, have children push layers of colored paper, lying flat on table, toward center from opposite sides.

14. Slip faulting may be clearer to the child if blocks, laid in a line on the floor, are pushed toward each other by children at each end.

15. Models made of colored clay or similar materials will help understanding.

16. Evidence of growing heat toward earth's core is reavealed in mine shafts, by appearance of hot springs, geysers, and volcanoes on earth's surface. Build a miniature volcano of paper mache'. Place fire under small tin containing ammonium bichromate and iron filings for vivid display.

17. To demonstrate the formation of different kinds of rock: fill tumbler with muddy water, watch heavier and lighter particles settle (sedimentary). Try pocket knife on granite. Search locale to observe granite used for building material (igneous). Scratch surface or drop hydrochloric acid on marble, or boil a piece in vinegar (metamorphic).

18. To note erosionby:
Wind:- Discuss dust storms: observe dust being transported in air from and to immediate surroundings.
Water:- Discuss placer mining for gold; demonstrate shifting of matter with garden hose.
To note weathering by:
Friction:- Crumble sandpaper; shake rocks together in a bag; have child report on sand blasting.
Oxidation:- Observe iron rusting.
Weathering:- Expansion and contraction of rocks. Observe and discuss reason for road and pavement construction with separators.
Observe ice wedges in rocks.
Place rock in tightly capped jar of water. Stand jar on cardboard in freezer. Witness action of expanded ice on jar and rock. Pressure of rock is 2,000 lbs. per square inch.
Gravity:- Observe action of falling rocks, soil, etc.

19. To witness that plants break rocks, observe on a trip or from pictures the action of plant and tree roots.

20. To observe earth's physical change, have child report on the formation of Applachian and Rocky Mountains, the rarity of such formations in our lifetime; e.g. Paricutin; explosions such as Krakatoa.

21. Storm's and ocean's action are changing forces on land and beaches.

22. The presence of limestone in the earth, evidenced by caves with their stalactites and stalagmites, may be read about, or visited. Watch action of Limewater in a tumbler when a child blows air into it through a straw. Pour off water, observe granular deposit when dry.

23. Crush sea shells to see nature's limestone deposit. Relate to presence of limestone deposits in central Pennsylvania an ancient inland sea. Collect samples from a variety of beaches where sands range in color from black to white, in texture from coarse to very fine.

24. Try growing plants in a variety of soil types, including one eroded from all. Contrast with results from pounded shale or limestone.

25. To show the relation of soil's consistancy to its drainage properties and that water is present in soil, arrange two glass tubes filled with different kinds of soil (sand vs. gravel, clay vs. humus). Cover bottoms with cheesecloth, pour same amount of water through each. Record time it takes water to run through each to cup below and amount of water collected.

26. Exhibit or visit fossil collections of different types; e.g., in coal, rock, amber, petrified wood, animal cases, coral. Hunt news accounts of recent finds.

27. Make a plaster of Paris mold of an animal or plant print. Color, for plaque decoration. (see Blough, p. 112)

28. A committee may report on uses of fossil deposits in industry. Show pictures of actual materials if possible.

29. Show aerial photographs, relate to U.S. dust bowls, show earth formations; e.g., deltas, dunes, deserts, water bodies, etc.

30. Consult encyclopedia or tests to discover extent of areas covered during these periods. Place cotton batting over globe to make the experience vivid. Glaciers of today are our contact with Ice Ages of the past.

31. Have children trace food chains to plants which are dependent on the quality of the soil. Man's health, at the end of the chain, in turn depends on the quality of the food he eats.

32. Visit the Academy of Natural Sciences as a culminating activity.

33. Class may dig a hole in the earth approximately 1 foot square, 6 inches deep, saving contents in a container. Examine soil in small quantities at a time, using hand lens. List everything found including types of soil, plant, and animal life. Return soil so that living things will not die, so that erosion will not begin, and so that the community will be attractive.

34. View new home areas where no turf is laid; compare with those well planted. Relate to western U.S. prairie grassland border areas, sometime planted by farmers hoping for one crop in two or three years.

35. When driving or walking observe use of trees planted in lines as windbreaks. Question reasons for use of snow fences on fields and sand dunes.

36. Have children build miniature compost pile, showing aerating properties of humus. The estimate of 6,000 to 10,000 years needed to build one foot of top soil should enlarge understanding.

37. Invite a farmer, a farm agent, or an agricultural authority to talk to the class about various methods of holding the soil (plowing, planting), about

specific plant enrichers and depleters of the soil. Relate these factors to historic migrations; e.g., Mayas, U.S. farmers, etc.

38. Cut small area of grass down to the roots (as sheep eat it). Watch for signs of erosion. Compare with overgrazed conditions on Navaho Indian Reservation; draw conclusions.

39. Plant two geraniums of same variety and size in same type of soil. Let children tend similarly except for the addition of fertilizer to one, no fertilizer to the other. Measure, draw pictures (life size) after suitable period of time has elapsed.

40. Note characteristics of various mineral specimens, labeling each; e.g., coal, iron ore, petroleum, etc. Study for density, color, texture, odor.

41. Interest individuals or group in drawing a frieze illustrating the formation of coal.

42. Write to the Coal Institute, Southern Building, Washington 5, D.C., for information about mining methods, mined-out areas. Bulletin board news articles regarding oil imports, and the importance of business of political relations with oil rich countries, tie the past to the present and the future. Write Standard Oil Company of New Jersey.

43. Appoint a committee to arrange a notebook of clippings to portray uses of minerals and of their by-products.

44. Interview fertilizer store or company representative for information and possible booklets on the value of mineral additions which spur soil's productivity.

45. Motivate children to investigate "hydroponics". Write General Biological Supply House, 761 E. 69th Place, Chicago 37, Illinois, for "Growing Plants in Nutrient Media". Purchase necessary materials to aid children in carrying out the experience in the classroom.

46. Set up a colored chart of daily mineral needs of the human body. Attach actual samples where possible; e.g., vitamins, minerals, carbohydrates,etc.

47. Consult a well-digger to learn about earth's soil and rock layer formation, the falling water level. A building contractor will have practical experience to impart regarding difficulties and expenses involved when striking bed rock in his foundation digging.

48. Write Soil Conservation Dept., Washington, D.C., for information on soil erosion and conservation methods practiced locally or throughout the U.S. Make erosion map of U.S.

49. Collect various kinds of samples of top soil from the woods, fields, roadsides, etc. Examine through magnifying glass.

50. Squeeze handful of humus. (Obtain sample from below exposed surface.)

51. Place various kinds of soil, including humus, in glass of water. Humus will float.

Grade 4

RESOURCES

1. Academy of Natural Sciences, 19 Street and the Parkway, Phila. 3, Pa. Call: James A. Fowler, RI 6-7622.
2. Commercial Museum, 34 & Spruce Streets, Phila., Pa. Call: H. McCollom, EV 6-9800.
3. Meridian Stone - Public Square, Main & Swede Sts, Norristown, Pa. (placed by David Rittenhouse 1784, to compute longitude and latitude of Norristown).
4. Norristown Brick Co., Forrest Ave., Norristown, Pa. Call: Mr. Moll, BR 5-0950.
5. Wagner Free Institute of Science, 17 & Montgomery Ave., Phila. 21, Pa. Call: Dr. Chambers, PO 3-6529.
6. Bryn Mawr College Vauz Rock Collection. Mrs. Garthly, Geology Department LA 5-1000.

RESOURCE PEOPLE

1. H. Leroy Beaver, Jr., 113 Oak Blvd., Lansdale, Pa. UL 5-3852
2. A well driller or a construction engineer (house builder)

FILMS

	Radnor	Film	Library
What is Soil #1522	Radnor	Film	Library
Wearing Away of the Land #1510	"	"	"
Earth's Rocky Crust #380	"	"	"
Earthquakes & Volcanoes #379	"	"	"
Exploring Caves #396	"	"	"
Geological Work of Ice #526	"	"	"
Glacier Adventure #529	"	"	"
Mineral and Rocks #906	"	"	"
Volcanoes in Action #1478	"	"	"
Yours Is the Land #1605	"	"	"
Glacier National Park #543	"	"	"
Conservation of Natural Resources #241	"	"	"
Earthworms #381	"	"	"
Nature of the Rampage #978	"	"	"
Petroleum, the Story of #1096	"	"	"
Conservation Needed #240	"	"	"

FILMSTRIPS

Our Changing Earth	(Curriculum Filmstrips)	
How Rocks Are Formed	(McGraw-Hill	Book Co.)
Gravity	"	"
Friction at Work	"	"

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Grade 4

PLANTS

Plants and their activities are important in our lives as dependent animals. This unit attempts to show many differences and some silmilarities exhibited by plants and their relatedness to our world of living things. Stress has been laid on the independent green plant that is most familiar to children. The study of plants lends itself to the approach of aesthetic values as well as to the ever present structural ones. It is hoped that a functional conservation of plant life will develop from the teaching of this unit.

CONCEPTS

Plants usually stay in one spot. (1)
Plants grow. (2)
Plants need food and water. (3-22-25)
Plants produce more of their kind. (4)
Plants respire (take in oxygen and give off carbon dioxide). (32-33)
Plants react to stimuli (light, gravity, water). (5)
Plants are made of cells (characteristic of all living things). (6)
PLANTS HAVE MANY COMMON ACTIVITIES.

Plants grow in hot climates. (7)
Plants grow in cold climates. (7)
Plants grow in wet places. (7-34)
Plants grow in dry places. (7-34)
Some plants grow in water. (7)
Some plants grow at high elevations. (7)
PLANTS GROW IN MANY PLACES.

Some plants grow from seeds: beans, peas. (4-8)
Some plants grow from cuttings: geraniums, African violet. (8)
Some plants grow from stems: potato, ohion, tulip (all are underground stems). (8)
Some plants grow from spores: bread mold, fern, mushroom. (8)
PLANTS BEGIN GROWTH IN VARIOUS WAYS.

Some plants contain bodies that enable them to make their own food. (29)
Some plants do not contain the bodies that enable them to make their own food. Show film strip on dependent plants.
Some plant stems contain tubes that carry materials to different parts of the plant. (12)
Some plants do not contain tubes. (30)
Some plants are simple in structure. (31)
Some plants are complex in structure. (9-10)
PLANTS DIFFER IN STRUCTURE

Complex plants have roots: anchorage, absorption. (11-25)
Complex plants have stems: contain conducting vessels. (12)
Complex plants have leaves: food factory. (13-29-27)
Complex plants have flowers that produce seeds. (14-24)
EACH PART OF A COMPLEX PLANT HAS A JOB TO DO.

Some plants are used for food. (15-20-35)
Some plants are used for clothing. (16)
Some plants are used for building. (17-21)
Some plants are used in medicine. (18-23)
Some plants are used for aesthetic value. (26)

Plants are the basis of any food chain. (19)

PLANTS ARE IMPORTANT IN OUR LIVES.

MATERIALS

- African violet
- Onion
- Fern
- Geranium
- Seeds (bean, peas)
- Irish potato(white)
- Limewater (slaked lime (CaO) in (H20)
- Pots (flower)
- Microscope
- Samples of various woods
- Yardstick
- Tulip
- Trowel
- Soil - sand
- Wax paper
- Veseline (Petroleum Jelly)
- Flat piece of glass (4" square)
- Bread
- Quart jar

TEXTBOOKS

1 - 4 : 50-63; 128-143
1 - 5 : 4-23
1 - 6 : 52-97
2 - 4 : 104-133
2 - 5 : 86; 106-126; 141-147
2 - 6 : 180-212
3 - 4 : 197-214
3 - 5 : 13-30; 33-36; 205-245
3 - 6 : 241-255

ACTIVITIES

1. Observe a plant in the classroom or schoolyard. Mark its location. Observe it a day or two later. Has it changed its location?

2. Measure the height of a young plant in the classroom or home; measure it a week later. Has the height changed?

3. What happens when the same soil is used over and over without adding fertilizer? Leach soil (wash with water mahy times) and plant seed. Will it contimue to grow?

4. Observe dandelion, grass, beans, peas, to see plants develop seeds. Plant seeds and observe new plants.

5. Turn plants away from the sun. Observe plants' reaction a day or two later.

6. Observe a piece of onion skin under a microscope to see cell structure.

7. Look up tropical plants, desert plants. Compare size of plants and structure of leaves. High elevation plants have stunted growth. This is an excellent opportunity for the children to make use of encyclopedias and report on one of the type plants mentioned. It is also possible that some of the children can bring in cacti, etc. If an aquarium is available, study water plants. This is a good time to study plant adaptations to their enviornment.

8. Plant seeds. Plant a geranium cutting or one from an African Violet. Plant an onion or an eye of an Irish or white Potato.

Moisten a piece of white bread, wrap in wax paper, and put in a dark warm place for several days. Take out and observe mold plants with a magnifying glass. Mold spores, contained on the knob-like structures of the plants, can be used to grow more plants.

9. Observe trees and shrubs. What are the main differences? (Tree has one main stem; shrub has many stems of equal size.)

10. Some stems are hard; observe trees and shrubs; e.g. maple or oak tree, forsythia, etc. Trees and shrubs have a bark covering and hard wood material for support in the stem. Some stems have green covering and no woody material, e.g. annuals, tomatoes, petunias, etc..

11. Pull out a plug of grass. Examine root structure; note many roots of equal size. Remove a dandelion plant in one piece if possible; compare root with that of the grass.

12. Use stems of celery to show they contain conducting vessels. Cut end of stem and put in colored water. Stems are used to support leaves also.

13. Leaves are the food factory of the green plant. Leaves function in the presence of light. Remove plant from the light and what happens? Return to the light.

14. Flowers as part of the plant used for reproduction. Examine some of the
common flowers and learn the function of the parts. Roses, buttercups,
and tulips are some of the plants that can be used. Azalea, forsythia,
chrysanthemum.

15. Name foods and tell if they come from plants. If so, also name the part of the plant we eat. Construction or use of charts make this more vivid.

16. Name plants used for clothing, e.g. cotton, flax, linen, etc.. Pictures and reports will aid this activity.

17. Wood used in building. Some of the boys could get samples of the most common woods from a nearby lumber company Some one could also check furniture stores to see the wide variety used in the furniture business, e.g. maple, white pine, oak, etc..

18. Plants in medicine. Quinine - from bark of the Chichona tree used in the treatment of malaria. Ergot - extracted from fungus on rye used to check bleeding. Opium and derivatives, morphine and codeine, are useful in medicine when taken as directed by a physician. Strychnine - from an oriental tree used in heart disorders. Antibiotics; e.g. penicillin obtained from molds and used to check the growth of disease germs.

19. Start with any form of animal life and follow the food chain (what the animal eats). It should be easily traced to some form of green plant.

20. The increasing world population has many people concerned as to sources of food to feed the additional mouths. Many scientists think we have a tremendous potential in farming our oceans. Algai growing in the sea have high protein value but do not have a pleasant taste. If we learn to use these sources, we can double or triple the population without worrying about starving ourselves off the face of the earth.

21. Trees should be farmed and replanted as is any other crop.

22. Take two plants of equal size and water them regularly. Stop watering one of them; observe. After wilting is noted, start watering again. Save plants whenever possible. Practice conservation in the classroom.

23. Familiarize children with poisonous plants; e.g. poison ivy and poison sumac. This can be done with colored pictures from books or actural plants in closed jars can be brought into the classroom. Exercise extreme caution.

24. Dissect a flower carefully and place parts on cards labeled: stamen, pistil, petals, sepals and receptacle. One of the better art students can make an enlarged drawing of a typical flower so that students can have an understanding of the parts before they actually study and draw one in detail.

25. Control growing plants by watering two differently. Water the leaves on one and the roots of another. Make sure other parts do not receive any water. This should show which part is used for the absorption of water.

26. Observe homes that are well landscaped and cared for and those that are not. Help bring in the aesthetic as well as the functional in the study of plants.

27. Make two small envelopes to fit a geranium leaf, one of black paper, the other of clear cellophane. Slip each of them over a leaf. In about a week or ten days remove both envelopes. What has happened?

28. Have a discussion on the fact that man has done more to upset the balance in nature than any other animal; e. g. , cut down trees, destroyed grasslands, killed many animals needlessly, etc..

29. Using a diagram of a cross section of a leaf explain the use of chloroplasts as workers in the food making process.

30. Simple plants, such as algaes and mosses, do not contain conducting vessels. - Refer to diagrams.

31. Take algae from acquarium or pond scum from nearby pond and examine under the microscope. Note lack of differentiation.

32. Cover the leaf of a growing plant with cold cream, vaseline, or other greasy material. This will seal the openings and the leaf should wilt in a couple of days. Air is necessary to plant growth.

33. Place a plant and beside it a small dish of limewater (calcium hydroxide solution) on a piece of glass under a glass jar and seal the bottom edge of the jar to the glass with grease. Prepare another similar (control) set without the plant. Set both away for a day or two. If the limewater turns milky or shows a white scum it proves that carbon dioxide is present. If there is a scum on the jar without a plant in it, it merely shows there is carbon dioxide in the air. Carbon dioxide plus limewater forms a white precipitate; this is usually a chemical test.

34. Assemble different terraria; desert, swamps, etc.

35. Talk about hybrids and the developing of new disease resistant plants.

RESOURCES

1. Morris Arboretum, 9414 Meadowbrook Avenue, Phila. 18, Pa. Contact Miss Mary Meszoly, Secretary. Call: Chestnut Hill 7-5232. Early booking ensures a guide. Specify date, time, rain date, size of group, ages, and special interests of the group.

2. Bartram's Gardens, 54th and Elmwood Avenue, Phila., Pa. Call SA 9-5281 Contact - Mr. Baehr, Superintendent.

3. Longwood Gardens, Kennett Square, Pa. Call: Kennet Square 230. Contact - John H. Marx, Superintendent. Free tour of one to two hours.

4. Wagner Free Institute of Science, 17th Street and Montgomery Avenue, Phila. 21, Pa. Call: ST 4-6529. Contact - Mr. Chambers, Director. Contact one week in advance.

5. Garden Club (nearest school - contact civic organization)

RESOURCE PEOPLE

1. Florist 2. Botanist 3. Gardner 4. Farmer 5. Nursery owner
6. Forester

FILMS

1. Forest Conservation (Radnor Film Library)
2. Leaves " " "
3. Life of a Plant " " "
4. Plant Growth " " "
5. Roots of Plants " " "

FILMSTRIPS

1. Plant Factories (SVE)
2. Telling Trees Apart (SVE)
3. Dependent Plants "

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Children: Encyclopedia Brittanica Jr.
World Book
Comptons Encyclopedia

WATER

Water is everywhere, and is indispensable to life. The main purposes of this unit are to make children aware of the tremendous role of water in our lives, to learn some ot its properties, and to become conscious of the need for water conservation.

CONCEPTS

Approximately three-quarters of the earth's surface is covered by water. (1)
Air contains water. (2)
Plants contain water. (3-4-5)
Animals contain water. (6)
WATER IS IN MANY PLACES.

Plants need water to live. (7)
Animals need water to live. (8)
ALL LIVING THINGS NEED WATER.

Water goes into many things. (9)
Water runs off many things. (9)
WATER GOES INTO SOME THINGS AND RUNS OFF OTHERS.

Water dissolves salt, sugar, baking powder, etc. (10)
Water does not dissolve tin, marble, sand, etc. (10)
Drinking water usually has dissolved minerals in it. (11)
WATER DISSOLVES SOME THINGS AND DOES NOT DISSOLVE OTHER THINGS.

Water can be changed to steam. (12)
Water can be changed to ice. (14)
Ice can be changed to water. (44)
WATER CAN BE CHANGED TO A GAS OR A SOLID

Water expands when it freezes. (13-14-15)
Ice floats on water (16)
WATER IN ITS SOLID FORM (ICE) IS LIGHTER THAN THE LIQUID FORM (WATER).

Water, in its gaseous form, can exert great pressure. (12)
Running water can exert great pressure. (17)
WATER CAN BE A SOURCE OF ENERGY

Warm air holds more water than cool air. (18-19)
Water condenses on cool surfaces. (18-23)
COOLING OF THE AIR MAY CAUSE WATER TO CONDENSE.

Clouds are condensed water in the air (24)
Water vapor which forms droplets of water and falls from the air is called rain. (21-25)
Water vapor which has crystallized in the air is called snow. (25)
Water vapor which forms droplets of water and freeze is called sleet. (25)
Water vapor which forms on a cold surface is called dew. (25)
Water vapor which freezes at ground level is called frost. (25)
WATER CONDENSES FROM THE AIR IN MANY FORMS.

Water evaporates from wet clothes, mud puddles, etc. (26-27-28)
Water evaporates from oceans, streams and lakes. (29)
WATER EVAPORATES INTO THE AIR.

Moving air increases the rate of evaporation. (30)
Temperature affects the rate of evaporation. (31)
The amount of surface area exposed affects the rate of evaporation. (32-33-34)
Humidity, the amount of water vapor in the air, affects the rate of evaporation. (28)
THE RATE OF EVAPORATION IS NOT ALWAYS THE SAME.

Streams, brooks and rivers are formed by water. (35-36)
Land may be built up by water. (37)
Mountains are slowly cut down by running water (erosion). (35-38)
Floods do damage to homes and land.. (39(
WATER CHANGES THE FACE OF THE LAND.

Modern living requires a tremendous amount of water. (40)
Water is scarce in some places on the earth. (41)
Water can be conserved. (41-42-43)
CONSERVATION OF WATER IS OFTEN A PROBLEM.

MATERIALS

Globe
Tin can
Sand
Jars
Cucumber, tomato, etc.
Bottles
Corks
Tea Kettle

TEXTBOOKS

1 - 4 : 185
1 - 5 : 183-186
1 - 6 : 170-175
2 - 4 : 177-229
2 - 5 : 137-159
3 - 4 : 56-65
3 - 5 : 122-123
3 - 6 : 48

ACTIVITIES

1. Look at a globe. The children can see that a large part of the earth is covered by water.

2. Fill a jar partly full of water. Let it stand aside. Observe the air bubbles that form on the edges of the jar.

3. Cut several fruits and vegetables, and notice how juicy or watery they are.

4. Put pieces of a potatoe or apple in a tin can and place the can on a hot plate.

5. Make a picture chart of fresh and dried foods.

6. Discuss the fact that human beings are composed of approximately 75% water.

7. Set aside a small plant. Do not water it.

8. Discuss African "water holes," shipwrecked sailors, adrift, camels, etc.

9. Fill a dish pan or bucket about one-half full of water. Let the children put many different things into the water; e.g., glass piece of metal, chalk, wood, sponge, cork, etc. Let the children take the objects out of the water to examine them. This activity, can be enlarged upon; e.g., some objects obsorb water to saturation point and excess water runs off; length of time object is in water may determine the amount of saturation, etc.

10. Put salt, sugar, or baking powder in a pan of water. Have the children observe what happens. Experiment with changes in the temperature of the water, using still water, stirring water, etc. Repeat process by putting tin, marble, sand, etc., in a pan of water.

11. Most drinking water contains some dissolved materials. Put a few drops of water on a clean piece of glass. Let the water evaporate.

12. Pour about a pint of water in a tea kettle. Fit the spout of the tea kettle with a cork stopper. The stopper should be put in firmly, but do not force it down too far. Place the teakettle on a hot plate. If the cork is not forced out after the water has boiled several minutes, remove the kettle from the hot plate. This is a safety precaution. Check to see if the cork has been inserted too tightly.

13. Fill a plastic container to the top with water. Place it in the cafeteria freezer.

14. Fill a small glass jar with water and screw the cover on. Set it in a freezor and let it freeze.

15. Plumbers or garage mechanics sometimes can supply metal pipes or parts that have been cracked by freezing water.

16. Float ice cubes in water.

17. Take the largest container available and put in several inches of sand and gravel. Pour in water from a tea kettle or hold the container under a faucet. Note: increasing the flow of water will increase the movement of the sand and gravel.

18. Place ice in a tin cup. Note outside surface. Repeat with hot water.

19. Exhale breath on chalkboard.

20. Observe cold water pipes and faucets.

21. Name places in the school where condensation takes place.

22. Observe a covered aquarium. When the air inside is cooled, it condenses on the glass.

23. Place an inch or so of water in a clean glass jar. Screw the lid on. Set the jar in a warm place; observe the jar. Now place the jar in a cold place; observe the jar.

24. Observe the different forms of clouds in the sky.

25. During the year draw attention to the various forms of precipitation when they actually occur. Also, refer to the past experiences of the children.

26. Wet a piece of cloth and let it dry.

27. Go outside after a storm to observe some puddles of water. Return later to observe what happened to the water.

28. On each of two days when the humidity is different, place the same amount of water in the same container and each day put it in the same place for the same length of time. Measure the amount of water in the jar each day and compare the two days results.

29. Show the film Watercycle. (Radnor films).

30. Mark off two eighteen inch squares about six feet apart on the chalkboard. Ask two children to wet the squares at the same time. As soon as the two children are finished, ask a third child to fan one of the wet sections.

31. Use five jars or dishes that are shaped the same. Place the same amount of water into each container.

32. Put the same amount of water in a small necked bottle and in a saucer.

33. Collect five containers with openings of different sizes. Place the same amount of water into each container.

34. Wet two similar handkerchiefs. Leave one crumpled in a ball and spread out the other one.

35. Mix three-fourths sand with one-fourth soil and pack it in a slant against one side of an acquarium. Pour water from a sprinkling can (or a milk container with holes punched in the bottom) over the mixture.

36. Have a class discussion about what happens to the rain water that runs off the roof of a house.

37. Pouring several pails of water on a sloping part of the school playground will help pupils to see how water carries soil with it and where the soil is deposited. (A hose would be very effective.)

38. Read an account of the formation of the Grand Canyon and study pictures of the earth's surface.

39. Refer to floods in the Poconos, Mississippi River area, etc. Pictures and children's experiences could be discussed.

40. Use the facts on water presented as the basis for a discussion of the amount of water used in modern living.

41. Read about areas that do not have sufficient water at all times and how it is conserved.

42. Discuss different ways of conserving water while washing hands, cleaning teeth, etc.

43. Ask the children if they recall their parents being requested not to water their lawns during prolonged dry spells.

44. Refer to the many natural and man-made situations which water is changed to ice and ice to water; e.g., frozen pond, ice cubes, etc.

RESOURCES

1. Philadelphia Suburban Water Company. Call: Mr. O'Leary, LA 5-1400

RESOURCE PEOPLE

1. Mr. O'Leary, LA 5-1400, will talk to the children in the classroom.

FILMS

Watercycle (Radnor Film Library)

FILMSTRIPS

Water Resources - Curriculum Filmstrips

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World Book Encyclopedia

The following information was submitted through the kindness of Mr. Thomas V. O'Leary, Philadelphia Suburban Water Company, 762 Lancaster Avenue, Bryn Mawr.

1. The average family (3.7) uses 60 thousand gallons of water per year.

2. A Hot Point Automatic Washer uses 37 gallons of water each complete cycle when fully loaded.

3. An air-conditioning unit uses 2½ to 3 gallons per ton of refrigeration without the use of any water conservation equipment. When water conservation equipment is used, the consumption decreases to .05 gallons per ton. To elimate waste the Philadelphia Suburban Water Company requests owners of air-conditioning equipment in excess of 5 tons, to utilize water conservation such as a cooling tower, evaporator condenser, spray pond, or cascade.

4. We supply water to 623,000 persons. Our accounts total 174,671, and we pipe water to 185,000 structures.

5. The Philadelphia Suburban Water Company owns approximately 6 thousand acres of land, practically all of which is in reservoir property.

6. The Philadelphia Suburban Water Company gets it supply of water from 5 rural streams: Crum Creek in Delaware County; Pickering Creek in Chester County, and Perkiomen, Neshaminy and Iron Works in Montgomery County; also from 4 deep wells situated in East Whiteland Township, Chester County; and Whitemarsh, Abington, Springfield Townships in Montgomery County.

7. There has been only one short period in recent years during which the Philadelphia Suburban Water Company has felt it necessary to ask consumers to restrict their use of water. That was in 1957 which was an unusual year for precipitation, in that there was a prolonged serious drought throughout the East. This condition, combined with high temperatures and humidity necessitated asking consumers to refrain from using water with which to wash cars or sprinkle lawns for a very limited period. Similar conditions prevailed in many other sections of the East at that time.

8. Now the Green Lane Reservoir, with its 4 ½ billion gallon water capacity, guarantees that this region will not face a similar crisis within the foreseeable future.

Additional information may be obtained from Mr. O'Leary, Philadelphia Suburban Water Company -- see Resources

MACHINES

In teaching about machines at the elementary level the objectives are: to help children see the great variety of things machines do, to give them experience in seeing how everyday machines work, and to make them more observant of the machines in their environment. The activities should be simple and should be done with familiar materials.

CONCEPTS

Work is moving something that has weight. (1)
Simple machines may increase force. (2-5-6-7-8-9-10)
Simple machines may increase speed (3-5-6-7-)
Simple machines may change the direction of the force (4-5-6)
MACHINES MAKE WORK EASIER BY CHANGING FORCE, SPEED AND DIRECTION.

The lever is a simple machine. (5-1)
The pulley is a simple machine. (6)
The wheel and axle is a simple machine. (7)
The inclined plane is a simple machine. (8)
The wedge is a simple machine. (9)
The screw is a simple machine. (10)
THERE ARE SIX SIMPLE MACHINES.

Friction occurs when two things rub together. (11)
Friction may be useful. (12)
Friction may be undersirable. (13)
FRICTION IS USEFUL IN SOME CASES, NOT USEFUL IN OTHERS

Sailboats and wind mills use wind to do work. (14)
Waterwheels use falling water to produce power. (15)
The steam engine derives its power from a fuel heating water. (16)
Gasoline and diesel engines use controlled explosions to develop power. (17)
Solar machines use the sun for their energy. (18)
Atomic power uses the energy contained in the atom. (19)
MAN USES COMPLEX MACHINES TO HARNESS ENERGY AND PRODUCE POWER

MATERIALS

- One 3 or 4 ft board
- Pulleys
- Ice cube tongs
- Wedge
- Piano stool
- Oil
- Block of wood
- Claw hammer
- Shovel
- Screws
- Marbles
- Pin wheels
- Egg beater
- Can opener
- Bicycle
- Auto jack
- Round pencils
- Can with stopper

TEXTBOOKS

1 - 6 : 212-233
2 - 4 : 242-269
2 - 5 : 212-246
2 - 6 : 325-333; 338-344
3 - 5 : 53-101

ACTIVITIES

1. Have a large, strong boy push on an immovable object. Have a smaller boy or girl lift or move a chair. Explain that the strong boy did not do work but the other one did. Work is moving something that has weight. Vast quantities of energy can be expended, but if something is not moved, work is not done.

2. Get a 3- or 4-foot board and a block of wood. Have some students lift various objects with the board and the block, changing the position of the block. If the board is strong enough a student may be able to lift the teacher. Be very careful in working with the board. This activity shows how force can be magnified.

3. Use the same board and block as above. Put the block of wood close to one end, move that end and note how far opposite end moves in the same length of time. An egg beater is another example of speed advantage by a simple machine.

4. Attach a single pulley to a horizontal bar, or place it on a board at the edge of a desk or table. An erector set pulley will do. Using two weights show that the only advantage is that of direction: a force down moves a weight up.

5. Use a board and a block and set up three lever types. These types are called classes. A first class lever has the clock or pivot point (fulcrum) between the weight to be lifted and the force exerted. A see-saw and a pair of scissors are examples of first class levers. In second class lever the resistance is between the fulcrum and the force. An example of a second class lever is a wheelbarrow or nut cracker. A third class lever has the force between the fulcrum and the resistance. An example of a third class lever is a shovel or ice cube tongs. Other levers are claw hammers and can openers. Our arms are levers.

6. Thread spools may be used as pulleys. Windows are raised with the aid of fixed pulleys and sash weights. A single fixed pulley is used to raise objects to much greater heights (flag pole). A combination of several pulleys, actually magnifies force. A block and tackle set up is of this type. They are used to beach boats and lift heavy objects. Pulley systems are used in garages to lift cars. Have students bring in a pulley or have the custodian of the school show a pulley. Permit students to set up and manipulate pulleys.

7. The construction of a wheel and axle (windlass) is a simple matter and can illustrate the fact that the force travels a much greater distance than the resistance. The pencil sharpener is an illustration of a wheel and axle. The egg beater is an example of the wheel and axle gear wheels to increase speed. Bicycles also illustrate gear wheels and the use of chains to drive the wheels.

8. Pupils can often find examples of inclined planes in the neighborhood. Loading platforms, gangways on ships, parking garages, etc. Stairways are examples of modified inclined planes. Pupils should make a simple inclined plane with a board and some books and use a toy wagon to pull a load up it.

9. A wedge consists of two inclined planes put together, and like the inclined plane, the wedge helps us to increase force. A small wedge may be driven into a piece of pine wood so that the wood will split. Short, stubby wedges require more force to drive them than long ones would. Knives, axes, etc., are wedges.

10. Another variation of the inclined plane is the screw. It is an incline that winds around in a spiral. If they examine a large screw, pupils can trace the spiral path of the grooves. Screws, like wedges, help us gain force, but we sacrifice distance and speed. An auto jack should be brought in to see how it enables one person to lift an automobile. Jacks are, of course, made of more than one simple machine, but the lever operates the screw and pupils can see how the screw makes many turns to lift the car only a short distance. The piano stool and airplane propellers are examples of the screw.

11. Rub hands together to produce friction; note heat produced. Rub very smooth surfaced objects together; observe. Repeat, using rough surfaced objects. What is the difference?

12. Friction may be desirable. Walking makes use of friction between the shoe and the surface walked on. Muscle massage, cigarette lighter, rosin for baseball pitchers, etc., make use of friction.

13. Friction reduces efficiency of machines by wearing away surfaces and producing heat which in most cases, is undesirable. Fill waste basket with books and pull across the floor; repeat with marbles under the basket. If box is substituted for waste basket, then round pencils can be used in place of the marbles. Wheels and rollers help reduce frictio (wheel and roller bearings). Oil reduces friction between moving surfac Pupils may talk with their fathers about what parts of the family automobile are greased and oiled when he takes it to the filling station for a grease job or lubrication. Rust increases friction; it should be prevented.

14. We have seen how machines multiply effort or speed or increase convenienc We have not considered the source of the force put into the machine. Let us turn now to those devices that develop power for man, making it possib to do a great deal of work in a short time.
Sail boats capture some of the forces of the wind and use it to push the boat. A model boat in a container of water with a fan or pupil blowing into the sail would show this. Wind mill blades catch the wind too, but are so designed to convert its force into a rotating motion. The power thus trapped may be used to pump water, to grind grains, or to spin electromagnet to generate electricity. Pin wheels will show how the force of the winds turn them.

15. The power of falling water has been harnessed by placing a water wheel in it. Special water wheels called turbines turn electromagnets that generate electricity. An activity would be to have various old time water wheels made and also a turbine; this would show the relative efficiency of each.

16. To show pressure exerted by steam secure a small metal can with a cork stopper. Do not use a can with a screw top. Place a little water in the bottom of the can, press the lid on tightly, place over heat source and step back. In a little while you will see the expansion forces of

steam. Some of the more interested students may want to make a Hero's engine which is a can with a jet on each side. The steam escaping from the jets will rotate the engine. The steam engine and the steam turbine are provided energy with burning fuels - wood, coal, gas or oil.

17. In the gasoline engine, the power is derived from the rapid expansion of gases produced by the explosive burning of gasoline. The explosion pushes the piston down with a force of several tons. This force is converted by the crankshaft into a rotary motion and is transmitted to the driving wheels of the automobile. The diesel engine uses oil in much the same way. It should be pointed out that the force of the explosion is permitted to move in only one direction. This also occurs in shooting a gun.

18. Various attempts have been made to utilize the heat of the sun directly. So-called sun machineshave been able to change water into steam and then furnish power. Solar water heaters are used to heat ho Bell Telephone Company has invented a device that changes solar energy directly into electricity.. Have students look up and find other uses of solar (sun's) energy. Have them check heat absorbed on black and white surfaces etc.

19. Atomic energy is the only source of energy that can not be traced back to the sun. The fact that our fuels do have a limit makes atomic ener more important for future use. Atomic engines for submarines, surfac ships, airplanes, etc., can be discussed. This will be studied in d detail in the sixth grade.

20. It should be remembered that even though the last section has been devoted to engines the basic parts of all compound machines are the six simple ones mentioned and discussed previously.

RESOURCES

1. A local building under construction to see use of machines
2. A manufacturing plant to see machines in operation

RESOURCE PEOPLE

1. School custodian 2. Carpenter 3. Automobile mechanic

FILMS

Power By Which We Live - Radnor Film Library
Simple Machine - "

FILMSTRIPS

Simple Machines (SVE) #EA 427-5

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LOWER MERION SCHOOL DISTRICT GRADE 4

OUR SOLAR SYSTEM

This unit is intended to introduce the child to the solar system. He is often conversant on the subject, but many of his concepts may be hazy or even wrong. Our main objectives are to supply the child with correct information and to begin to deepen his understanding of the place of our earth in the scheme of things.

CONCEPTS

The sun is the center of the solar system. (1)
At least nine planets revolve around the sun. (1)
At least thirty-one moons revolve around the planets. (1)
More than two thousand asteroids revolve around the sun. (1)
Numerous comets revolve around the sun on eccentric orbits. (1)
Billions of meteors move around the sun. (1)

THE SUN IS THE CENTER OF A SYSTEM OF HEAVENLY BODIES THAT REVOLVE AROUND THE SUN.

The sun is a star. (2-3)
The sun shines by virtue of its own atomic activities. (2-3)
The sun is 93,000,000 miles away. (2)
The distance to the next nearest star is 26,000,000,000,000 miles. (4)

THE SUN IS A NEARBY STAR.

If we were to make a trip to each planet when it is nearest the earth and if we were able to travel by rocket at seven miles per second (25,200 m.p.h.), the trips would take the following lengths of time: (5)

Venus	- 1 month- 3 days	Saturn	- 3 years - 6-1/2 months
Mars	- 1 month- 27 days	Uranus	- 7 years - 3-1/2 months
Mercury	- 2 months - 22 days	Neptune	- 12 years - 2 months
Jupiter	- 1 year - 8 months	Pluto	- 12 years - 1 month

(A trip to the sun would take five months and one day.)

THE SOLAR SYSTEM IS VERY LARGE.

Facts about the Planets. (6-7-8)

Planet	(miles) Diameter	Distance from Sun (Millions of Miles)	Length of Year	Length of Day	Number of Moons
Mercury	3,010	36	88 days	88 days	0
Venus	7,610	67	225 days	225 days	0
Earth	7,918	93	365 1/4days	1 day	1
Mars	4,140	140	687 days	1 day	2
Jupiter	86,900	480	11.9 yrs.	10 hrs.	12
Saturn	71,500	890	29.5 yrs.	10 hrs.	9
Uranus	29,500	1,800	84 yrs.	11 hrs.	5
Neptune	26,800	2,800	164.8 yrs.	16 hrs.	2
Pluto	3,600	3,700	248.4 yrs.	6 days	0

THE PLANETS VARY IN SIZE, DISTANCE FROM THE SUN, LENGTH OF THE YEAR AND DAY, AND THE NUMBER OF MOONS.

Conditions on the Planets. (7-8)

Planet	Atmosphere	Surface Temperature
Mercury	Little or none	Apprx. 770°F to-400°F*
Venus	Very dense atmosphere, no oxygen or water	Apprx. 220°F to-400°F*
Earth	Mixture of Chem. elements chiefly nitrogen and oxygen	Apprx. 0°F to 100 °F
Mars	No trace of oxygen, very little water vapor	Apprx. -20°F to 80°F
Jupiter	Dense atmosphere containing poisonous gases	Below -200°F
Saturn	Dense atmosphere containing poisonous gases	Below -200°F
Uranus	Dense atmosphere containing poisonous gases	Below -200°F
Neptune	Dense atmosphere containing poisonous gases	Below -200°F
Pluto	Dense atmosphere containing poisonous gases	Below -400°F

*Mercury and Venus do not rotate. One side is hot and the other cold.

CONDITIONS ON THE PLANETS VARY; LIFE AS WE KNOW IT IS UNLIKELY TO BE FOUND ON OTHER PLANETS.

The earth rotates on its axis once every twenty-four hours. (9)

The earth receives its light from one principal source. (9)

DAY AND NIGHT ARE CAUSED BY THE ROTATION OF THE EARTH ON ITS AXIS.

The earth is tilted on its axis. (10)
The earth revolves around the sun. (6-7-10)
A year is the time it takes the earth to revolve around the sun. (10)
Because the earth is tilted and revolves around the sun the duration and intensity of the sun's rays vary during a year. (10-11)

SEASONS ARE CAUSED BY THE TILT IN THE EARTH'S SURFACE AND THE REVOLUTION OF THE EARTH AROUND THE SUN.

Solar eclipses occur when the moon passes between the sun and earth. (12)
Lunar eclipses occur when the earth passes between the sun and moon. (13)

ECLIPSES OCCUR WHEN THE SUN, EARTH, AND MOON ARE IN A STRAIGHT LINE IN SPACE.

There are many theories about how the solar system was formed. (14)
No generally accepted, adequate theory has been achieved. (14)

SCIENTISTS DIFFER IN THEIR THEORIES ABOUT THE ORIGIN OF THE SOLAR SYSTEM.

MATERIALS

Globe
Ball
Flashlight

TEXTBOOKS

1 - 4 : 66-77
1 - 5 : 65-95
1 - 6 : 30-51; 99-103
2 - 4 : 270-285
2 - 5 : 9
2 - 6 : 247-283
3 - 4 : 91-138
3 - 6 : 187-214

ACTIVITIES

1. This first part of the unit attempts to set a stage for the more detailed study of the solar system that follows. The teacher may decide to confine the study to the sun, planets, and moons, or if the children are interested and able, to pursue it in more detail. It is very possible that some children may know little or few correct facts about the solar system at the beginning. Discussion should begin on a very elementary plane. Artists' conceptions of the solar system are practically a necessity. The set of definitions that follow should be helpful:

Asteroids - tiny planets (really chunks of rock) that swarm between the orbits of Mars and Jupiter. The largest, Ceres, is 480 miles across. Most asteroids are only a mile or so in diameter.

Comet - huge collections of rocks traveling on schedule in narrow, elliptical orbits about the sun. Gases in the loose rocks become heated and stream away from the planet, producing its spectacular tail.

Galaxy - a collection of billions of stars in space. Our own system is called the Milky Way galaxy.

Meteorites - small, cosmic bodies (stones and metallic rocks) that travel in orbits around the sun. When a meteorite collides with the earth's atmosphere, we see a meteor.

Planet - the word means "wanderer". These bodies have no light of their own, but shine by reflected sunlight. The earth is a planet.

Planetarium - an instrument (and also the building that it is in) for showing artificial stars and planets on an artificial sky.

Satellite - solar bodies that accompany planets in definite orbits. Our moon is a satellite of the earth.

Solar System - any star with planets revolving around it in regular orbits.

2. Children could read about, report on, and discuss the sun. Its composition, size, and distance are foreign to any experiences the children have had, but some realization of the true facts may be gained by comparisons; e.g., the sun's temperature to the temperature of a kitchen stove, the sun's size to the earth's size, the sun's distance to the distance between points on earth, etc.

3. Again we have a concept completely foreign to the child's experiences, except for one thing -- the hydrogen bomb. A superficial comparison between a hydrogen bomb explosion and the atomic activity in the sun, stressing the tremendous difference in quality and quantity, might help the child gain some insight into this concept.

4. The relation of the sun to the other stars is also difficult. A possible comparison may be the appearance and heat of an electric bulb held very close to the child with the appearance and lack of heat of electric bulbs seen at a distance. (The lights of a city from an airplane or distant hill, etc.)

5. A recital and discussion of these facts should give the child some idea of the size of the solar system.

6. The children could make a clay or paper cutout model of the solar system. They will have to decide on a scale that they can [illegible] in order to get all the members of the solar system [illegible] the [illegible]. Distances are so great that it is practically impossible to [illegible] scales for the planets and the distances between [illegible] could be shown separately by using a twenty-[illegible] paper, and allowing six miles to represent the [illegible] from the sun, etc.

7. The children could read about and make reports on the various planets.

8. The children could make up imaginary stories about the planets. Care should be taken to make the stories accurate as far as scientific facts are concerned.

9. Place a chalk mark on a globe to indicate Pennsylvania. Darken the room and shine a strong, directed light on the globe. Rotate the globe slowly so that the children can observe what happens during one complete revolution.

10. "There is some disagreement about how much elementary school pupils can understand about the actual causes of seasonal changes. The usual demonstrations, using small balls to represent the earth at different seasons and tilting them to show the effect at different times of the year, seem very difficult for most elementary groups. Probably the best we can do is help pupils see: (1) that summer days are longer than winter days; consequently, the earth has more hours of sunlight and therefore more heat in summer (and fewer sunlight hours, which means less heat, in winter); (2) that in summer the sun is more directly overhead and consequently gives more heat than it does in winter, when it is lower in the sky and its rays are oblique rather than direct. Both these phenomena are observable."[1] The detailed concepts are included with the hope that some of the more able and more interested pupils may be able to go into the cause of seasons in detail. A method of constructing a homemade planetarium is given by Blough on p. 165

[1] Blough, pp 164

11. Duration of the sun's rays. Keep a record of the time of sunrise and sunset for a certain period. Intensity of the sun's rays. Darken the room. Shine a flashlight on a piece of paper from directly above. Draw a circle where the light falls. Turn the flashlight so that the light falls at an angle. Again draw a circle around the light. Compare the size of the two circles. When the light shines directly, it is concentrated; therefore the heat is concentrated.

12. Shine a flash light on a globe in a darkened room. Slowly pass a small ball, representing the moon, between the light and the globe.

13. Pass the globe between the light and the ball.

14. Have the children look up and report on different theorieis about how the solar system was formed. All such theories should be considered as what they are -- unprovedtheories.

RESOURCES

1. Fels Planetarium, Franklin Institute Building, [illegible] Parkway, Phila., Pa. Contact: Mrs. Olley LO 4-3600. [illegible] per child

FILMS

Earth in Motion - Radnor Film Library

FILMS

Earth in Motion - Radnor Film Library
The Solar System - Radnor Film Library
What Causes the Seasons - Radnor Film Library

FILMSTRIPS

The Sun and Its Family (SVE)
The Sun and Its Planets (SVE)
The Earth in Space (SVE)
Comets and Meteors (SVE)
Why the Seasons (SVE)

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LOWER MERION SCHOOL DISTRICT GRADE 4

SAFETY AND FIRST AID

The purposes of this unit are to make the elementary child more aware of the dangers that are about him, help him know how to avoid these dangers, and enable him to render simple first aid in case of an emergency.

The section on first aid is not meant to be an extensive first-aid course but is designed to help the fourth grade child. All the activities need not be done, the teacher will stress just those activities pertinent to his classroom situation.

CONCEPTS

Know your playtime safety rules. (1-2-3-4-5-6-7-8-9-10-11-47)
Know your pedestrian safety rules. (12-13-14-15-16-17-47)
Know your bicycle safety rules. (18-19-20-21-22-23-24-25-47)
Know your fire safety rules. (26-27-28-29-30-31-32-33-34-35-36-37-47)
Know your electrical safety rules. (27-38-39-40-47)
KNOW YOUR SAFETY RULES.

First aid can help children with cuts. (41-42-43-44-45-46-47)
First aid can help children with burns. (41-42-43-44-45-46-47)
First aid can help children with splinters. (41-42-43-44-45-46-47)
First aid can help children with nosebleed. (41-42-43-44-45-46-47)
First aid can help children with insect bites, and bee stings. (41-42-43-44-45-46-47)
First aid can help children with blisters. (41-42-43-44-45-46-47)
First aid can help children with foreign objects in their eye. (41-42-43-44-45-46-47)
First aid can help children with stomach aches. (41-42-43-44-45-46)
First aid can help children with sprains, strains, or bruises. (41-42-43-44-45-46-47)
First aid can help children who faint. (41-42-43-44-45-46-47)
First aid can help children with poison oak, ivy or sumac. (41-42-43-44-45-46-47)
FIRST AID HELPS CHILDREN.

MATERIALS

jacknife
camera
film
bicycle
candle
matches
asbestos pad
large pie plate
three candles
two glass jars
fourth cup vinegar
tablespoon baking soda
large oaktag disc
gauze pads
gauze bandages
adhesive tape
scissors

ACTIVITIES

1. Encourage the youngsters to comment on why we include a unit on safety in our health classes.

2. With the children's help, list on the chalkboard the safe places to play. (School playground, ball field, open fields, sidewalks, providing they are not to busy, etc.

3. Discuss unsafe places to play. List should include: (1) busy sidewalks, streets, and roads; (2) empty houses or homes under construction; (3) railroad property; (4) quarries; (5) around electrical wires; (6) polluted streams; (7) tall trees; (8) parked vehicles.

4. Word scramble of safe and unsafe places to play. When the children unscramble each word let them explain whether it is a safe or an unsafe place to play. Examples; 1. aygplndoru (playground) 2. resttise (streets) 3. uarrqies (quarries) (4.railroad rpoptery (railroad property) 5. allb elfid (ball field), etc.

5. Composing safety rhymes can be fun for the children. Examples, (The teacher could write the first line on the chalkboard.)

   A street is no place to play
   Too many children get hurt that way

   Wear white at night
   Or carry a light

6. Write on the chalkboard the names of various play equipment. Ask, "What safety rules do you need to remember when using each of these." Examples:

   Skates
   Skate on sidewalks.
   Take skates off before crossing a busy street.
   Watch where you are going.

   Chemistry set
   Get help from a grown up person until you know how to use the set.
   Do only the experiments that are suggested.
   Never mix things, "just to see what will happen."

   Jacknife (Demonstrate with a jacknife.)
   Cut away from the body.
   Do not carry an open knife.
   Do not leave your open knife on the ground.

   This is an excellent time to review the rules for the use of school playground equipment.

7. Discuss the rules for safe swimming. Examples:
   1. Do not swim alone. (Buddy system)
   2. Stay within easy reach of the shore.
   3. Never dive into strange waters.
   4. Avoid horseplay in the water.

5. Avoid swimming during an electric storm.
6. Never jokingly call for help.
7. Don't go in swimming too soon after eating.

8. Safety while boating. Ask the children how many of them have been on boat rides. Discuss the safety measures we should take when boating. Inform the children that as boating becomes more popular there are also more boat accidents. Here are a few common type accidents:
    1. Tipping over because of people standing up.
    2. Running into another boat at high speed.
    3. Being upset by waves caused by the propeller of a larger boat moving at high speed.
    4. Running into someone swimming.

9. Ask the children "What safety rules will help people avoid accidents of the type listed in activity 8"? Boat safety rules should include the following:
    1. Know how many people the boat can carry safely and do not overload it.
    2. Stay seated when you are in a small boat. Do not stand or change seats when you are in the water.
    3. Do not go boating when the water is rough or when there are signs of a storm coming.
    4. If the boat should upset, try to hang on to the side of it to keep afloat. Most small boats will float when upset.
    5. Non-swimmers should wear a life preserver.

10. To review, ask the children, "What rules about boat safety do these words suggest: Storm? Changing seats? Overloading? Life preserver? Upset boat? Rough water?

11. Language arts. Have one of the children write a business letter to the U.S. Coast Guard in Washington, D.C., to ask for its pamphlets on safety in small boats.

12. Discuss the reasons why we take time to review the rules for safe walking.

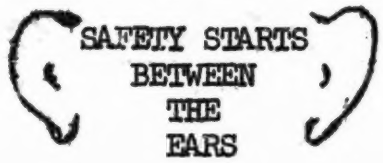
13. Let's make a list of safe walking rules. Make a list of safe walking rules on the chalkboard. (Use the children's suggestions) Some examples:
    1. Cross at corners and other specially marked places.
    2. Look right and left before crossing the street.
    3. Don't enter a street from between parked cars.
    4. When walking at night wear white, or carry a light.
    5. When walking in an area without sidewalks, walk facing traffic.
    6. Obey the directions of all traffic signs, lights, and officers put there for our safety.

14. Take the children to a suitable street corner and have them demonstrate the safe walking rules.

15. Candid camera. Have interested camera bugs take pictures of classmates putting the safe walking rules to use.

16. Darken the room as much as possible, or use the audio visual aids room. Let the children see the difference in the visibility of "Pedestrians" who walk in front of them dressed in (a) dark colors (b) pastel colors, and (c) in a white jacket, scarf or shirt.

17. Have the children explain this poster.



18. Discuss. In a recent year bicycle accidents accounted for 600 deaths in the United States. They injured 30,000 more. Most accidents resulting in death were caused as the bicycle rider swerved into the path of a car, truck, or bus. Others were caused by a person coming out of a driveway without looking, and by individuals entering the street from behind parked cars. Still others were caused by racing on bicycles.

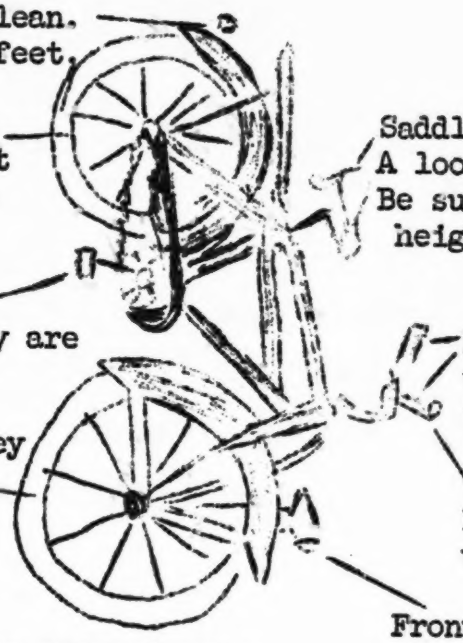
19. Ask the children if they know of any bicycle accidents. What was the cause of each?

20. Instruct the children to sit quietly for two minutes and think about bicycle safety. At the end of this time ask them to help you write some good bicycle safety rules. Some suggestions:
    1. Keep your bicycle in good condition.
    2. Keep on the right side of the road. (Same direction as traffic is moving.)
    3. Ride only as fast as safety permits. (Ride slowly on crowded or slippery streets.)
    4. Do not cut in and out of traffic.
    5. Use both hands to steer.
    6. Use correct signals for turning and stopping.
    7. Make turns carefully after looking around to make sure nothing is coming.
    8. Watch and obey traffic lights and stop signs.
    9. Look carefully before coming out of driveways or between parked cars.
    10. Avoid riding at dusk or in the evening.
    11. Do not be a show-off.

21. Have the pupils look in newspapers and magazines for information on bicycle accidents and bicycle safety.

22. Interest the children in making bicycle safety slogans, posters, cartoons, etc.

23. Bicycle safety begins with a safe bike. The following bicycle safety test may be reproduced by a ditto machine. Each child should have his own copy.



Reflector: Keep it clean. It must be seen 300 feet.

Brakes: Be sure they stop the bicycle fast enough to skid tires on dry pavement.

Pedals: Put in new rubber treads if they are worn.

Wheels: Make sure they do not wobble.

Tires: Inflate to correct pressure.

Spokes: Replace broken ones at once.

Saddle: Be sure it is tight. A loose seat may mean a fall. Be sure the seat is the right height.

Handle Grips: Replace worn handle grips. Cement them on tightly so they will not slip.

Horn or Bell: Be sure it works properly.

Front Light (white): Keep it clean. It must be seen 500 feet.

My bicycle is safe. Yes ☐ No ☐

Adopted from "Fun on a Bike", National Safety Council.

24. Have one of the youngsters bring his bicycle to school. Let pupils conduct an inspection. They could then inspect their own bicycles and report the results to their classmates.

25. Language arts. Have one of the children write a business letter to the National Safety Council, 425 North Michigan Avenue, Chicago 11, Illinois, for information concerning its free catalog. Catalog refers to material on bicycle safety, fire safety, swimming safety, etc. (By obtaining one of its booklets on bicycle safety it would be possible to set up a definite bicycle safety program. Information would include performance and skill tests. Cost would be minimal.)

26. Discuss the meaning of fire prevention with the children. Most fires start because of carelessness and could be prevented. The best way to fight fire is to keep it from starting.

27. Lead the children into a discussion of the ways they could help prevent fires. From the discussion compile a list of fire prevention rules.

    Examples:

    1. Be careful with matches. Put them out before you throw them away. Use safety matches if possible. Keep large kitchen matches in a covered metal box.
    2. Keep an outdoor fire from spreading. Build a small fire. Make it on bare ground in a place where the wind will not blow it toward anything that may catch fire.

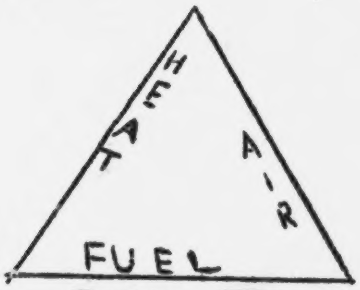
3. Before you leave an outdoor fire, put it out. Pour water on it or cover it with sand or dirt.
4. Never use kerosene or gasoline to help start a fire.
5. Do not leave oily rags wadded or thrown in a pile. Keep them in a metal container.
6. Do not use worn electric cords.
7. Replace a "blown" electric fuse with another of the right size. (This should only be done by parents)
8. Do not play with firecrackers or any kind of fireworks. (This is also illegal.)
9. Do not use naphtha or gasoline to clean clothes.
10. Conduct fire drills at home.
11. Know the location of the nearest alarm box.
12. Know the phone number to call in case of fire.

28. Ask the children what they would do in case of fire.
Suggestions:
1. Remain calm.
2. Call for help.
3. Sound the nearest fire alarm. Stay near the box until the fire engine comes.

29. The fire drill in school may save our life if a fire breaks out. Discuss the following questions with the class; Why should everyone respond to the fire signal at once? (Review the school fire drill procedure so that each child knows exactly what to do.) What should they do if they are in the gym when the fire bell sounds? On the playground? In the auditorium? In the lunch room? What would they do if the nearest exit is blocked off?

30. With the children compile a fire safety check list for their home. With their parents' help they could inspect their home for fire hazards. (Duplicate copies could be made on the ditto machine so that each child could have an inspection check list.)
Examples should be:
Are greasy or oily rags kept in a metal container?
Is trash disposed of promptly and properly?
Are all cleaning fluids guranteed to be non-flamable?
Are any exits blocked by furniture.
Is the yard kept free from dry leaves and weeds. etc.?
Are matches discarded only after it is certain that they are completely extinguished?
Are fire drills held regularily?

31. Discuss the fire triangle and explain by removing any side of the triangle it will prevent fire from starting, or it would put a fire out. Fire needs (1) Something to burn (fuel) (2) Air (oxygen) (3) enough heat to light it.



FIRE TRIANGLE

32. Demonstrate the fire triangle with a candle, a match, a wide mouth jar or bowl, an asbestos pad, and a pie plate. Set a short candle in a bowl or jar, light the candle. Cover the jar with the asbestos pad. The candle will go out. (No air.) Now place the candle in the center of the pie plate. Keep lighted match away from the candle. It won't light. (No heat.) Finally remove the candle, (the fuel) and discuss..

33. To demonstrate how a carbon dioxide fire extinguisher works we need two glass jars, two short candles, half cup warm water, a tablespoon of baking soda, and some vinegar. Melt the ends of the candles and stand each candle in a glass jar. Pour a half cup of vinegar into one jar with a funnel. Be careful not to wet the candle wick. Light the candle. Does anything happen to the candle flame? It remains lighted. Pour the warm water and baking soda into the second jar. Do not wet the candle wick. Light the candle. Does anything happen to the flame this time? It remains lighted. Now pour a little vinegar into the second jar. Vinegar is an acid. When the vinegar mixes with the baking soda white bubbles of carbon dioxide forms. Observe what happens to our candle flame now. (It should go out.)

34. Have the children compile a list of thoughtful fire safety questions and then invite a fireman to visit their classroom to help you answer their questions. (He could also help explain the fire triangle, and demonstrate the different types of fire extinguishers.)

35. The class could plan an exhibit to show what they have learned about fire safety. The exhibit could include some illustrations of fire prevention rules, made by the youngsters.

36. Cut out newspaper stories about fires and make a collection. List the different causes of fire reported in the newspapers.

37. Have some of the gifted children write papers about fire safety.
Some suggested topics would be:
Information about fires in our community and their causes.
Calling the fire department from the alarm box or by telephone.
The dangers of false alarms.
Prevention of fires.
How to use a fire extinguisher.
Value of fire drills in school.
Where to build a bonfire.

38. Introduce the topic of electrical safety by discussing the many ways that electricity helps us each day. Following this lead the children into a discussion of the many fires, serious accidents, and deaths that have been caused by carelessness and lack of simple fundamentals of electrical safety. Ask the children to help construct a list of safety hints that may save them from serious injury or death.
Some suggestions should be:
    1. Disconnect all electrical appliances when they are not being used.
    2. Never use an electrical appliance or an electric cord that you know is out of order.
    3. Never try an experiment with an electrical appliance or an electric cord that is connected to the current in your home.

4. Never touch an electrical appliance with wet hands. Also be sure not to touch it if any part of your body is against a water pipe, or radiator.
5. Never touch electric wires or use an electric cord on which the covering is worn.
6. Stay away from broken wires that hang down from poles or buildings.
7. Never climb a pole that supports electric wires.
8. Never touch an electric cord or wire with wet hands.
9. Never take hold of a wire or cord while any part of your body is touching a water pipe, faucet, or radiator.
10. Never try to repair a "burned-out" fuse. Use a new one.
11. Always turn off the current when you put in a fuse.
12. Never stand on a damp floor in the basement when you put in a new fuse.
13. Never touch a switch with wet hands.
14. Never touch a switch when any part of your body is against a water pipe, a faucet, or radiator.
15. Never use a knife, fork, or spoon to get bread out of an electric toaster while it is turned on.
16. Do not use a damp cloth to clean the outside of an electric heater while it is turned on.
17. Do not hang wet clothes on an electric heater to dry.
18. Never touch an electric heater while you are in a bathtub or when any part of your body is touching a water pipe, a faucet, or a radiator.
19. If you use an electric heating pad, be sure that it has a waterproof cover.

39. The children could help their parents conduct an electrical safety check of their house. They could report the results of their safety test to the class.

40. Have the children make electrical safety posters, slogans, rhymes, etc.

41. Discuss the meaning of first aid. (First aid is the first care given in case of an injury. It is given an injured person to lessen the pain and make him more comfortable until the doctor arrives.) Sometimes, if the injury is a small one, first aid of the right kind is the only care that is needed.

42. Have the children construct an attactive "First Aid Booklet." The booklet could contain their definition of first aid, drawings and pictures concerning first aid, newspaper or magazine clippings, and directions for first aid in case of accident. These booklets will be the children's own and will be kept by them after the unit is over. They might be placed in the family's medicine cabinet. Some of the directions are:

First Aid for Severe Bleeding

Usually direct pressure can stop bleeding. Apply direct pressure by pressing a sterile cloth pad against the wound. If a sterile pad is not available, a wad of any clean material that is at hand may be used. If an arm or leg is bleeding, raise it slightly, using a blanket, pillow or some other object.

First Aid for Cuts

Wash a small cut with soap and water and put a sterile bandage or a clean cloth over the cut. Press down on the bandage to stop the bleeding. If the cut is large or deep, a doctor should take care of it as soon as possible.

First Aid for Puncture Wounds

Wash with soap and water. Cover with a clean sterile bandage or cloth. See a doctor on all puncture wounds.

First Aid for Splinters

Sterilize a needle by holding it over a flame. Before using a sterilized needle to take out the splinter, wash the skin with soap and water and then with alcohol. After splinter is removed, clean the wound by pressing above it to cause a little bleeding. After bleeding has stopped, put on a sterile bandage.

First Aid for Nosebleed

The person should sit with his head thrown back or lie down with head and shoulders raised. We may pinch the nostrils together -- or pack them lightly with gauze and then pinch. Sometimes cold wet towels, applied to the face will help stop the bleeding.

First Aid for Insect Bites and Stings

For insect bites, apply a paste made of cold cream and baking soda -- or a sterile piece of gauze soaked in ammonia water. Calamine lotion helps releive itching. For bee and wasp stings, apply ice or ice water. (This procedure helps give relief for any insect bite.)

First Aid for Infected Wounds

See a doctor about an infected wound. If the doctor cannot be seen at once -- apply hot wet cloths to the wound. Dip the cloths in boiled water to which has been added 3 heaping tablespoons of table salt -- or 6 tablespoons of Epsom salts-- per quart of water.

First Aid for Burns

If the burn is a small one without blisters it can be treated at home. If the burn is blistered or deep, or covers a large area, see a doctor at once. For burn without blisters: put burn ointment on the burn. (or fat without salt like olive oil or lard.)

First Aid for Blisters

If the blister is a large one, see your doctor. You may let a small blister alone, or you may decide to open it. Wash the blister with soap and water. Sterilize a needle by holding it over a flame. Put an antiseptic such as alcohol on the blister and on the skin around it. Put the needle in blister at its outside edge. Using a sterile piece of bandage, press gently on the edges of the blister to remove the watery liquid. Put a sterile bandage over the blister.

First Aid for Foreign Object in Eye

If a foreign object gets in the eye, do not rub the eye. Wait for a while to see if the tears will wash out what is in the eye. If tears cannot wash it out, go to your mother or teacher or some other grown person for help. The grown-up will see that you get to a doctor for further care.

First Aid for Severe Stomach Ache

Avoid taking of laxatives or other medicines or food. (Stomach pains can be symptons of appendicitis.) Call a doctor at once.

First Aid for Fainting

If a person feels faint -- have him lie flat, with his head low. Or if this is not possible at the moment, have him lower his head between the knees and breath deeply. If a person has fainted -- keep him lying flat for at least ten minutes. (If he gets up too soon he may faint again.) Loosen his collar. Send for a doctor if patient does not regain consciousness almost immediately.

First Aid for Sprains

A sprain is an injury to a joint. Sprains are painful and swelling usually occurs. Elevate the part if possible. In an ankle is sprained, carefully remove the shoe. Put ice or cold packs around the injured part. What looks like a bad sprain may actually be a broken bone. Call a doctor immediately.

First Aid for Strains

Strains are injuries to muscles or tendons. Rest injured muscle. Apply heat; be careful not to blister. Gentle rubbing upward on injured part. Massage to loosen up muscles.

First Aid for Bruises

Apply ice or cold cloths immediately to reduce swelling and relieve pain. Elevate injured part. If skin is broken, treat as any open wound.

First Aid for Poison Ivy, Oak and Sumac

Following exposure, wash thoroughly with thick soap suds in hottest possible water, then apply alcohol. (Laundry soap best.) Use calamine lotion. If rash appears, be sure to see your doctor.

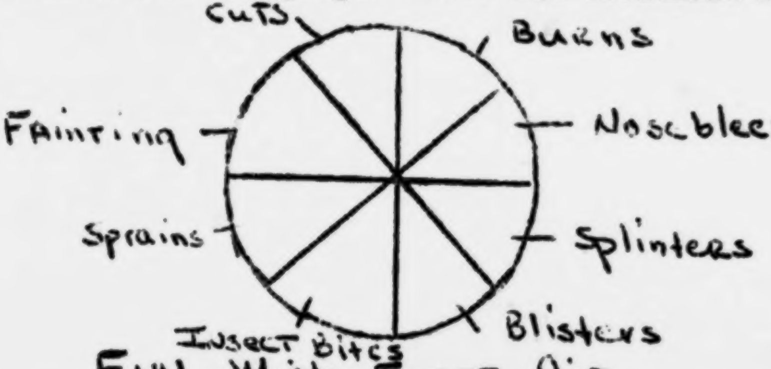
43. The children may want to get some first aid supplies for their home. First aid supplies and equipment for the home should always include the following:

    - Absorbant cotton
    - Gauze bandages
    - Gauze pads
    - Gauze
    - Adhesive tape
    - Soft paper handkerchiefs or tissue
    - Scissors
    - Safety pins
    - Small enameled basin or bowl
    - Hot water bag
    - Thermometer
    - Eye Cup
    - Toothpicks or applicators
    - Alcohol
    - Boric Acid
    - Tincture of green soap
    - Aromatic spirits
    - Ointment for burns

44. First aid television show: The children could make up their own television show and use this means to demonstrate first aid treatment for various accidents.

45. Let's play accident ward: Make a list of typical accidents, nosebleed, fainting, splinter in finger, etc. Then cut and separate the list of accidents into individual slips. Fold each slip and place it in a hat. Each child will draw a slip in turn, read it to the class, and then demonstrate the first aid treatment for the accident named on the slip.

46. Using a large disc and a spinner may make first aid demonstrations more interesting. Each child in turn, will spin the arrow. When it stops spinning and points to the name of an accident, the child will demonstrate the proper first aid treatment for this accident.



FUN With FIRST AID

47. Divide the class into groups and give each group time to plan and present a short skit involving some aspect of safety. Suggestions: "Safety When Swimming," "Safety on Roller Skates,""Fire Safety," etc.

GRADE 4

RESOURCES

1. American Automobile Association, Philadelphia, Penna.
   Call: LO 8-3700 Contact: Mr. Max
2. Keystone Automobile Club, Philadelphia, Penna.
   Call: KI 5-6000 Contact: Mr. Edward P. Curran
3. Local newspapers for accident reports.

RESOURCE PEOPLE

- Fireman
- Policeman
- School Nurse
- Doctor
- Swimming Instructor
- Scout Master
- Boy Scout
- School Principal

FILMS

Our Community 1034	Radnor Film Library
Safe Living at Home 1276	" " "
Safe Living at School 1277	" " "
Safe Living in the Home 1278	" " "
Safety on Our School Bus 1279	" " "

FILMSTRIPS

Be a Better Pedal Pusher	SVE and Nat'l Safety Council
Happy Hollow Makes the Honor Roll	" " " " "
Safety in the Streets	National Film Board Canada
Safe Home-Safe Living	SVE and Nat'l Safety Council

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American Red Cross, First Aid Textbook the Blakiston Co., Phila., 1958.

The Health Happiness Success Series, Grades 4-5-6. Lyons and Carnahan, 1958.

Macmillan Science, Health, Safety Series, Grades 4-5-6. Macmillan, 1959.

The Basic Health and Safety Program, Grades 4-5-6. Scott, Foresman and Company, 1958.

World Book Encyclopedia.

Useful pamphlets and booklets:

"Accident Facts" (Annual edition)($.75) National Safety Council, 425 North Dearborn Avenue, Chicago 11, Illinois.

Child Safety Prgoram package subscription ($3.30 a year.) National Safety Council, 425 North Dearborn Avenue, Chicago 11, Illinois.

"First Aid Guide," ($.25) Superintendent of Documents, U. S. Government Printing Office, Washington 25, D.C.

"Fire Safety for Teachers of Intermediate Grades," National Education Association, 1201 Sixteenth St., N.W., Washington, D.C.

"Foundation for Safe Living," National Safety Council, 425 North Dearborn Avenue, Chicago 11, Illinois.

"Much to Do About Safety," Same as above.

Safety Education Data Sheets, Same. (Data sheet #1 Bicycles; #9 Electric Equipment; #22 Safety in the Gymnasium; #27 Swimming; #32 Winter Sports; #48 Unauthorized Play Places; #69 Playground Apparatus; #71 Baseball (Price 1 to 9 copies, 10 cents each; quantity rates are available.)

Other Sources for material:

American Automobile Association. 1712 G Street, N.W., Washington, D.C.

Bicycle Institute of America. 122 E. Forty-Second Street, New York 17, N.Y.

Johnson and Johnson, New Brunswick, N.J. (A free helpful kit for bicycle safety programs.)

Center for Safety Education. New York Universtiy, Eight Fifth Avenue, New York 6. N.Y.

National Commission on Safety Education, N.E.A. 1201 Sixteenth Street, N.W., Washington, D.C.

Children:

Compton's Pictured Encyclopedia

American Red Cross, First Aid Textbooks, The Blakiston Company, Philadelphia, 1958.

The Health Happiness Success Series, Grades 4-5-6. Lyons and Carnahan, 1958.

Macmillan Science, Health, Safety Series, Grades 4-5-6. Macmillan, 1959.

The Basic Health and Safety Program, Grades 4-5-6. Scott, Foresman and Company, 1958.

World Book Encyclopedia.

ELEMENTARY SCIENCE REVISION - 1962

EVALUATING THE UNITS

FIFTH GRADE

Gerald Craig wrote, "The fear of science felt by some adults is usually not found in children. The adult may have been conditioned to a dislike of science in part by previous contacts with science at the high-school or college levels; whereas children, having felt no such conditioning, are still following their natural impulses. Teachers can free themselves from any such negative reactions if they will attempt to see the environment and science through the eyes of children. Encouraging children in a classroom to express themselves freely without fear of being humiliated about their ideas of natural events, has assisted many teachers to understand children and at the same time gain a new look at the world themselves." [1]

In the fifth grade three major areas: Living Things ("Animals"); Non-Living Things ("Ancient Plants and Animals") and ("Weather"); and Energy ("Matter and Energy") continue to be built upon and are enlarged.

At this stage the material offered could easily become technical. Care should be taken to keep it within the scope and interest of the children, and not to be misled by a small group of children who may appear, and who may actually be able, to do far more. Properly guided, these few can help enrich the study of a subject without violating the basic approach.

The evaluation sheets for the fifth grade units indicate the "Weather," "Ancient Plants and Animals," and "Animals" were received enthusiastically by both teachers and children. "Matter and Energy" was thought by some to be too comprehensive. Originally matter, heat, light, and sound were combined because of a feeling that these areas should be treated at the intermediate level. Experience has shown that the second grade unit in sound, which is quite detailed, was received well. Conversely, the sixth grade unit on the universe was judged to be too intangible. For these reasons, sound will be centered in the second grade, light has been added to the sixth grade unit on the universe, and new units on matter and heat have been constructed for fifth grade and are included.

Additional suggestions that were made for the other units appear on the next page.

The new health unit "Disease Control and Prevention" is also included.

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[1] Science For Today's Children, Ginn, 1958, Pg. 6.

Additional Suggestions for Teaching the Units:

ANCIENT PLANTS AND ANIMALS

Make fossil prints from mud, clay, plaster of paris or cement.

Activity 25 may be misleading. Unless the cave was very deep, the temperature would tend to remain constant the year around.

The various eras vary tremendously in length. Although the following are merely educated guesses; scientists estimate:

Azoic - 2 to 3 billion years
Archeozoic - 1 billion years
Proterozoic - 500 million years
Paleozoic - 350 million years
Mesozoic - 125 million years
Cenozoic - 75 million years

ANIMALS

The story of men like Linnaeus and Jussieu, who helped classify living things, would add a personal note to this study.

WEATHER

For activity 15 small aluminum pie pans work well.

The U.S. Weather Bureau at International Airport no longer conducts tours for elementary school classes.

Grade 5

WEATHER

This unit should mold previous concepts of air and water and help the children realize that weather is the result of the interplay of natural forces at work in our world. It should also help the children comprehend that weather affects us all vitally and that constant effort is being made to understand and to forcast it more accurately so that we may live with it more intelligently.

CONCEPTS

The sun heats the earth's surface unevenly. (1-2-3-4-5)
Air is heated by contact with the earth's surface. (6)
Winds are caused by uneven heating of the earth surface. (7)
The water cycle occurs constantly. (8-9-10)
All weather occurs in the troposphere. (11)
THE SUN, THE AIR, AND WATER PLAY LEADING ROLES IN WEATHER.

Air temperature is measured with a thermometer. (12)
Air pressure may be measured with a barometer. (13-14)
Wind velocity may be measured with an anemometer. (15)
Wind direction may be indicated by a weather vane. (16)
Relative humidity may be measured with a wet and dry thermometer bulb. (17)
The amount of rain can be measured with a rain gauge. (18)
THE WEATHER DATA CAN BE MEASURED ACCURATELY

Air Temperature changes. (19)
Air pressure changes. (19)
Wind velocity and direction changes. (19(
Relative humidity changes. (19)
THE WEATHER CHANGES FROM DAY TO DAY

Cumulus clouds are big and fluffy, have flat bases, and are usually seen in fair weather. (20)
Cirrus clouds are high in the air and made of bits of ice. They are usually seen in clear weather. (20)
Stratus clouds cover the sky making an oven, gray layer. They are usually seen in winter (20)
Nimbo stratus clouds are thick, dark gray clouds. They bring rain and snow (20)
DIFFERENT KINDS OF CLOUDS HAVE BEEN RECOGNIZED. CLOUDS HELP US FORCAST THE WEATHER

A thunderstorm is a heavy shower accompahied by thunder and lightning. (21-22)
Thunder is the result of a rapid expansion and contraction of air (21-22)
Lightning is a discharge (spark) of electricity. (21-22-23-24)
A hurricane is a widespread, violent windstorm usually accompanied by heavy rain. (21-22-25)
A tornado is a highly destructive, rotating funnel shaped cloud. (21-22-25)

DIFFERENT TYPES OF WEATHER DISTURBANCES HAVE BEEN RECOGNIZED.

Isobars are lines on a weather map connecting places of equal air pressure. (26-27)
Isotherms are lines on weather map connecting places having the same temperature. (26-27)
Weather fronts on weather maps are shown by heavy, dark lines. (26-27)
Wind force and direction are indicated on weather maps. (26-27)
WEATHER MAPS CHART TEMPERATURE, WIND, AIR PRESSURE, AND THE MOVEMENTS OF AIR MASSES.

Some weather sayings are based on facts; others are not. (28)
Workers at weather stations record and report useful information. (29)
Weather information is used to forecast weather. (29-30-31)
WEATHER FORECASTING IS A SCIENCE

MATERIALS

Globe
Flashlight
Thermometers
Plaster of Paris
Balloons
Glass jars
Bowls
Shoe string
Tin can
Convection box
Barometer (aneroid)
2 rubber balls
Kettle

TEXTBOOKS
1 - 5 : 45-63
2 - 4 : 1-33
2 - 5 : 309-334
3 - 6 : 33 -59

ACTIVITIES

1. With a globe and a light illustrate how day and night follow each other.

2. Shine a flashlight beam on a piece of paper hold at a right angle. Tilt the paper back and observe how the same amount of light is spread over a larger surface. Compare this to the sun and the earth.

3. Get two saucers of water. Put one in bright sunlight and leave it there for ten minutes. Put the other saucer of water next to it, and leave both saucers in the sunlight for another minute. Touch the water in both saucers.

4. Put some dry soil in a bowl. Pour water in another bowl of the same size. Let both stand until they approximate room temperature. Place both in bright sunlight. Which one has warmed up more in the sunlight. You can use a thermometer to find out.

5. Vary the above experiement by placing the two bowls in a refrigerator for 15 minutes.

6. Take a thermometer out of doors and test the temperature of the air at heights varying from one inch to five feet. Repeat the experimemt over grass, cement, shady spots, etc.

7. Make or borrow a convection box. Use a wooden box about twice the size of a chalk box. Cut two holes in the top of the box and place a lamp chimney over each hole. Put a small candle in the box under

one of the chimneys. Light a splinter of wood. Blow it out. Hold the smoking splinter over the chimney that has no candle under it.

8. Heat a kettle; and when the steam starts to come from the spout, hold cold plate or pie tin in the cloud.

9. Observe a covered terraium.

10. Place an inch or so of water in a clean glass jar. Screw the lid on. Set the jar in a warm place and then in a cold place.

11. Have the children read about, report on, and discuss the troposphere, stratosphere, ionosphere and exosphere.

12. Measure the temperature of the air in different partsof the classroom, the hallways, in sunlight, shade, etc.

13. If possible, have a child bring in a barometer.

14. Stretch a piece of rubber balloon over the mouth of a milk bottle, and tie it securely. With glue, fasten a straw to the center of the rubber. Arrange the bottle and straw so that it points to a lined piece of paper fastened to the wall or chalkboard.

15. Cut two rubber balls in halves and nail them to the ends of two crossed sticks. Stick a nail through the point where the sticks cross. Mount this on a simple wooden stand.

16. Construct a simple weather vane. (Cardboard or wooden arrow, a nail, a wooden stand.)

17. Fasten two thermometers to a board hung on the wall. Keep one thermometer bulb wet by means of a shoestring of double construction. Slip one end of the shoestring over the bulb and let the other end rest in a dish of water. A detailed account of how a hygrometer works may be found in an encyclopedia.

18. A simple rain gauge can be made by setting an old ruler upright in a tin can and pouring in an inch or so of plaster of Paris.

19. Measure and record the changes in air temperature, air pressure, wind and velocity and direction, and relative humidity over a period of time.

20. Too often we study clouds in the classroom where there are none. There is no reason why we shouldn't take pupils outdoors to look at them. The weather bureau's chart of clouds (see Resources) is a great help in identifying them. Through their reading, pupils should be able to answer such questions as "What are the clouds made of?" "How high are different clouds?" "What kind of weather are they likely to bring?"

21. Show the film "Story of a Storm"

22. Have the choldren make reports on storms, lightning, thunder, etc.

23. This is a good time to review safety rules about lightning; e.g., keep

away from tall trees standing alone, keep off lakes or other bodies of water, keep away from iron fences. This does not mean you are in danger every time you see lightning. The chances of being hit by lightning are infinitesimal. Still, there is no point in inviting trouble.

24. On a cool, dry day scuff your shoes on a rug or thick carpet. Then bring your finger close to a nearby object.

25. Order Hurricane Warnings: Tornadoes: What they are and What To Do About Them; The Hurricane (see Resources).

26. Study actual weather maps from the daily newspapers.

27. Sample copies of the Washington weather map are available free from the Chief of the U.S. Weather Bureau, Washington 25, D.C.

28. Refer to the following list of weather sayings. Try to determine their scientific basis, if any:
    1. Story of the ground-hog's shadow.
    2. Thick coat of fur on mammals and heavy feathers on birds indicate a cold weather.
    3. If March comes in like a lion, it will go out like a lamb.
    4. Lightning never strikes twice in the same place.
    5. When the moon changes, the weather will change.
    6. Rain before seven, clear before eleven.
    7. When the stars are out, it will not rain.
    8. If it is a hot sticky day, there will be a thunder storm.
    9. When there is a ring around the moon, it will rain.
    10. Swelling feet indicates a change in the weather.

29. If possible, visit a weather station. (See Resources)

30. Listen to weather reports on the radio or watch them on television to see and here what is reported.

31. Keep a record of the accuracy of weather forecasts for a two-week period.

RESOURCES

1. United States Weather Bureau, International Airport, Philadelphia, Pa. Contact: H.P. Adams, Meteorologist, BE 2-4275; WA 2-6662. Any size group for the tour.

2. Superintendent of Documents, Washington 25, D.C. Cloud Code Chart, 10¢ Instruments Used in Weather Observing, 5¢; Hurricane Warnings, 5¢ Tornadoes : What They Are and What To Do About Them, 5¢; The Hurricane, 15¢ Code Figures and Symbols, 10¢; Weather Forecasting, 20c; The Weather Bureau at Work, 10¢.

FILMS

What Makes Rain	(Radnor Film Library)
Story of a Storm	" " "
The Weather	" " "
The Weather Station	" " "

Atmosphere and Its Circulation (Radnor Film Library)
Watercycle

FILMSTRIPS

Clouds, Rain, and Snow (SVE)
Why does the Wind Blow "
Why Does the Weather Change "
Why Does it Rain, Snow, Hail, Sleet (SVE)

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Craig, Gerald S., Science for the Elementary School Teacher. Ginn, 1958

Children: Gallant, Exploring the Weather. Garden City, 1957
Wyler, The First Book of Weather. Watts, 1956
Schneider, Everyday Weather and How It Works. Whittlesey, 1951
Encyclopedia Brittanica Junior
World Book
Comton's Picture Encyclopedia

LOWER MERION SCHOOL DISTRICT GRADE 5

ANCIENT PLANTS AND ANIMALS

There is obviously a wealth of fascinating material for the child to assimilate from this study. More important are the attitudes and concepts he will form as he learns. Building on the child's ever-present interest in the topic, this study should awaken him to some awareness of the years consumed in the earth's formation; to the fact that one-half the time passed before any life appeared on its surface; and to an understanding that man is cognizant, as yet, of only the merest fragments on which to base his deductions regarding it.

CONCEPTS

We divide earth's history into periods called Ages. (5)
Earth probably began from flaming gases. (Show filmstrips: How Earth Began; Our Changing Earth).
Earth's surface changed due to volcanic action and cooling processes. (25-26)
The Lifeless Age is known as the Azoic Era. (5)
EARTH'S BIRTH OFFERED NO OPPORTUNITY FOR LIFE (AZOIC ERA).

Primitive plant life may have begun with one cell. (2-3-6-32)
As community living began, each cell performed special work for and benefited from the group; e.g., seaweed. (10-2)
We term the period when plant life was in its "infancy" The Archeozoic Era. (5)
SIMPLE PLANT LIFE AND EXPERIMENTS IN COMMUNITY LIVING BEGAN (ARCHEOZOIC ERA).

One-celled animal life, called Protozoa, began in the seas. (2-7)
Cells lived in groups for greater efficiency; e.g., sponges, coral, jellyfish, anemones. (11)
How to differentiate between simple plant and animal life is still undetermined by scientists. (8)
We term the period when animal life was in its "infancy" The Proterozoic Era. (4-5)
SIMPLE ANIMAL LIFE AND EXPERIMENTS IN COMMUNITY LIVING BEGAN WITH THOSE OF PLANT LIFE (PROTEROZOIC ERA).

Hard shelled animals, called trilobites, dominated the earth during The Age of Trilobites. (12-9-13-14)
Needing greater "motility", animals developed backbone (vertebrae), gills, fins, streamlining - The Age of Fishes. (12-14)
Parts of earth dried. Some animals ventured on land. (27)
We call this the Age of Amphibians. (15-14-27-28)
Growing variety of life forms, preserved in rock and earth, provide a basis of study for scientists. (29-30)
This "childhood" period in the development of earth's life we label The Paleozoic Era. (4-5)
CHANGING ENVIRONMENT FORCED LIFE TO ADAPT OR DIE (PALEOZOIC ERA).

Conifers (soft wood) and hardwood trees, bearing flowers, grew tall. (22-13)
Insects dependent on flowers appeared. (16)
Reptiles, called dinosaurs, took to sea, land and air as their habitat - Age of Reptiles. (12-24-14)
Theories offered for extinction of dinosaurs are varied. (18)
Present day descendants of dinosaurs are crocodiles, lizards, snakes, turtles, etc. (17)
This "adolescent" stage in the growth of life on earth we call The Mesozoic Era. (5-12)

PLANT AND ANIMAL LIFE GREW MORE NUMEROUS AND VARIED: THEIR STRUCTURE, MORE COMPLEX (MESOZOIC ERA).

Great crustal upheavals produce mountain ranges; e.g., Andes (26)
Ice Ages altered earth's contours. (31)
Grasses, to be used later by man, became widespread. (19)
Mammals, differing structurally from earlier animals, are warm-blooded, suckle their young, adapt to environment. (20).
Man, a mammal, appeared recently on earth - Age of Man. (4)
Earth's life became "adult" in the period called The Cenozoic Era. (4-5)

THE CHANGE GOES ON (CENOZOIC ERA).

MATERIALS

Fossils
Seaweed (if possible)
Paint (tempera)

Hay infusion or Sample of stagnant water
Plaster of Paris
Mural materials

Toothpicks
Modeling clay
Lava sample

TEXTBOOKS

1 - 5 : 98-109
1 - 7 : 111-160
2 - 3-: 115-136
2 - 4 : 134-141
2 - 6 : 213-246
3 - 4 : 19-36
3 - 6 : 271-294

ACTIVITIES

1. Display of a fossil collection will point up the various kinds of remains scientists utilize in making deductions about early life; e.g., fossil cases, prints, petrifications. Continue to add to the collection throughout the unit, noting the kinds of fossil remains found in our state.

2. Study sample of stagnant pond water under microscope to try to recognize early forms of life present today. Place hay in tumbler of water, and let stand 10 days to permit growth of one-celled organisms.

3. Try to imagine one-celled life crushed under a great weight of earth. Draw conclusions about the lack of fossil remains of this privitive form of life. Scientists must deduce and guess to arrive at some conclusions.

4. Draw a series of twelve globes, one for each month of the year, representing the stages of earth's development. Note man's arrival at December's end. As events occur in the study add information to chart. Enthusiasm will continue with chart's evolution.

5. Search for the etymology of the names given the six Eras will correlate with language study and enlarge the child's interest in word meanings. Be aware of difference between Age and Era.

6. Discuss growth of algae on swimming pool walls in summer, or in an aquarium and the commercial products marketed to kill it. If possible have some seaweed to study under microscope.

7. Draw pictures of various kinds of one-celled life. Refer to books, periodicals if microscope is not available.

8. Have children discuss bases for differentiation between plant and animal life, imagining themselves in the place of the authorities. Consult reference books for arguments to uphold their position. Discuss Euglena.

9. Compare trilobites to sand crabs and to hard shelled invertbrates (snails, clams, starfish, etc.) on beaches today. See Blough, P.93, to include scorpion, dragon fly, etc.

10. Look up cell structure and division as related to plants and human beings.

11. Study pictures of coral reefs; e.g., Australia, U. S. shores.

12. Form committees to paint a series of murals showing plant and animal development through the ages and eras. This is an activity continuing as the study unfolds, combining well with #14.

13. Consult dictionary, encyclopedia.

14. Model clay replicas of ancient life, inserting toothpicks to keep appendages from breaking. Paint. Display in proper Age with appropriate background. Some child may perfer to find an animal impression for molding in plaster of Paris. (Blough, P.112).

15. If possible get tadpoles and watch physical changes.

16. Consult a fruit growers association about interdependence of fruit production and insects (bees). Write Department of Agriculture, Washington, D.C.

17. Study characteristics and life habits (breathing, body temperature, egg laying) of modern and prehistoric reptiles.

18. Learn terms "herbivorous," "carnivorous," "omnivorous." Have class vote on reasons offered for dinosaur extinction, to encourage understanding of dilemma faced by scientists.

19. Read Chapter XII of Robinson Crusoe. Trace the history of man's use of the world's major grains.

20. Draw a Mammal Chart with a list of as many mammals conforming to the accepted pattern as the children can suggest. Draw a separate chart of deviates; e.g., platypus, spiney anteaters, marsupials, etc. The Zoo may have specimens to see.

21. Learn a poem (e.g. "Meet the Platypus"); read a short book aloud or have a book report on The Shy Stegosaurus of Cricket Creek. Arrange a sketch using models constructed as characters.

"MEET THE PLATYPUS" - Isabel Harris Barr - Published in the N.Y. Herald Tribune (on the arrival of the Platypus at the Bronx Zoo).

No wonder people make a fuss
Over the duck-billed platypus,
A scrambled, prehistoric creature
That boasts at least one salient feature
Of furry mammal, fish and bird,
And looks exceedingly absurd.
It clucks like any broody hen,
Has webby feet, and a strong yen
For shrimps and worms, and odder still
A beaver's tail and a duck's bill.
Nature was not herself when she
Fashioned this curiosity.
Yet, in a world that seems to run
Rather to form, such things are fun.
Why mourn the dodo and the rock,
The phoenix and the jabberwock,
When here and now we have with us --
The paradoxical platypus?

22. Trace the development from ferns and conifers to modern evergreens, from ancient flower bearing trees to decidous hardwoods.

23. Recall experiences of seeing decaying life in marshes, of dead flowers in vase of original water.

24. Estimate the size of the giant dinosaurs by comparing their measurements to those of the classroom and school building. Also include the range in dinosaur size to those of small present day animals. Project on auditorium screen for life-size proportions, (Opaque Projector).

25. Evidence of growing heat toward earth's core is revealed in deep caves. A child traveler or parent may describe a cave he has visited. Magazine pictures of volcanic activity or a sample of hardened lava would interest children.

26. To observe earth's physical changes in the past have child report on the formation of the Andes Mts. Another may describe the former extent of the Gulf of Mexico, covering Central U.S. north to the Ohio River.

To realize the rarity of such formations in man's lifetime have children report on Mt. Lassen (U.S.), Mauna Loa, 1950 (Hawaii), Kilavea, 1954 (Hawaii).

27. Crush sea shells, collect different beach samples to see nature's limestone deposit. Relate to presence of limestone deposits in central Pennsylvania, an ancient inland sea.

28. Interest individuals or group in drawing a frieze illustrating the formation of coal. Produced by warm lush Carboniferous Period; we call the The Coal Age.

29. Have an imaginary tour of the prehistoric section of the Smithsonian Institute, Washington, D. C. Discuss scientific knowledge necessary to assemble these displays.

30. Visit N orth Wales to see dinosaur prints and to hunt fossils. (South of Town, on right side of road just before crossing Reading Railroad.)

31. To see evidences of 4 previous Ice Ages, observe lines of boulders collected in areas; e.g., Cornwall, Pa. Study rock scratchings for deductions. Relate to formation of Great Lakes.

32. Obtain bioscope (Ardmore Junior High) to show living one-celled creatures.

33. The study of fossil life is called Paleontology; those specializing in the field, Paleontologists.

RESOURCES

1. Academy of Natural Sciences, 19 St. and the Parkway, Phila. 3, Pa.
   Call: James A. Fowler, RI 6-7622

2. University of Pennsylvania Museum, 33 and Spruce Sts., Phila., Pa.
   EV 6-1241

RESOURCE PEOPLE

1. Museum authority

2. Local school teacher or college professor who has studied the subject deeply or made it his hobby

FILMS

Life In a Drop Of Water #814	Radnor Film Library
Paramecium #1078	" " "
Exploring Caves #396	" " "
Prehistoric Times #1117	" " "

FILMSTRIPS

The Story of Fossils	McGraw-Hill Book Co.
Prehistoric Animals	" " " "
How Our Earth Began	Curriculum Filmstrips
Our Changing Earth	" "
About Our Earth	" "

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Palmer, Jacqueline, Going to Museums. Ray Publishing Co.
Parker, Bertha, Stories From the Rocks. Row Peterson, 1950
Science Through the Seasons Grade 5. Lippincott, 1956

GRADE 5

MATTER

The objectives of a unit on matter in the fifth grade are to develop a consciousness that there is an underlying unity in nature, to develop an understanding of the ninety-two building blocks of our world, to develop an understanding that matter follows laws of nature, and to lay a foundation for the study of atomic energy in the sixth grade.

CONCEPTS

All matter is composed of atoms, which are in ceaseless motion. (1,2,3).
All matter has mass and takes up space. (4, 5, 12)
There are ninety-two kinds of atoms in nature, called elements. (1,9,10,11,13)
Atoms are linked together in definite combinations called molecules. (6,7,14,16,17,18)
All matter on the earth is made up of molecules. (6,7,8)
ATOMS ARE THE BUILDING BLOCKS OF OUR EARTH.

Molecules brought together in varying amounts are called mixtures. (19)
Mixtures are the result of a physical change. (19,20,21)
The molecules in mixtures retain their characteristics. (20)
There is an almost limitless number of possible mixtures. (19,20)
THERE ARE MANY MIXTURES FOUND IN NATURE.

Molecules of two or more elements that are linked together in definite combinations are called compounds. (9,15)
Compounds are the result of a chemical change. (22,23,24,25,26)
Compounds differ from the molecules that make them up. (24,26)
Scientists have identified over one half million compounds. (1)
THERE ARE MANY COMPOUNDS FOUND IN NATURE.

MATERIALS

- Pictures
- Balloons
- Diagrams
- Buttons
- Aluminum or copper foil
- Onion
- Shoe Box
- Ice
- Sugar
- Red Ink
- Glass
- Magnifying Glass
- Match - paper
- Plate
- Nail
- Iron Filings
- Powdered Sulphur
- Test Tube
- Magnet
- Pie Dish
- Rubber Hose

TEXTBOOKS

1 - 4 : 200-201; 211-217
1 - 5 : 78-88; 111-127
1 - 6 : 197-203
2 - 4 : 209-211; 234-238
2 - 5 : 38-81
2 - 6 : 95-132
3 - 5 : 46-62 teachers' edition; 103-160

ACTIVITIES

1. All matter on the earth is made up of the ninety-two natural (found in nature) blocks or elements; the smallest part of any element is the atom. These atoms are found in combinations called molecules. (Eleven other elements that do not occur in nature have been made by man; the number of man-made elements may possibly increase.)

   Although we have only twenty-six letters in our alphabet, we use these twenty-six letters in combinations to create hundreds of thousands of words. In the same way, the ninty-two atoms in nature make up the more than a half million compounds that scientists have discovered. Scientists can work with the atoms of elements to create new combinations, such as the new synthetic materials and plastics.

   Although there are only two kinds of human beings, males and females, there are many different kinds of families. You can have just a man and his wife. You can have a widowed mother and three children, all girls. You can have an old married couple with a son, a daughter-in-law, and two grandsons. There are thousands of possible kinds of families.

   In the same way, even a few different kinds of atoms can combine into many different kinds of groups. This is why there are so many different kinds of things in the world.

   Discuss with the children the various types of families that are to be found in their own classroom.

2. Even though the most powerful microscope will not reveal an atom, scientists have learned about them by using their imaginations. We can "see" atoms in the same way by the active use of our imaginations.

3. With the new electron microscope, scientists have been able to take photographs of molecules. Find pictures of these in magazines. For example, picutres of molecules taken with the electron microscope have recently appeared in Newsweek and National Geographic.

4. Discuss if there is anything in the room that is not matter. Try to develop the concept that matter is anything that has mass and occupies space. Are tables, chairs, blackboard, door, floor, the electric lights matter? Even though these objects are apparently so dissimilar, in what ways are they alike? If the children mention the light in the room or the heat of the sun's rays on the skin, we must identify them as forms of energy.

5. We must not confuse mass with weight. Our bodies, its blood, bones, tissues, and organs, are made up of a mass of atoms and molecules that have a definite weight on the earth. On the moon, however, a smaller body than our earth, we would still have the same mass but less weight, due to the smaller gravitational pull of the moon. On Jupiter, a much larger planet than the earth, we would still have the same mass, but increased weight, due to the increased gravitational pull of the giant planet.
   Weight is the attraction that one body has for another; mass is the amount of space that matter takes up. The concepts of mass and weight are often confused.
   The atom of even the smallest and lightest element, hydrogen, has mass and takes up space.

   Illustrate with objects of the same size but made of different materials; e.g., paper block and block of wood.

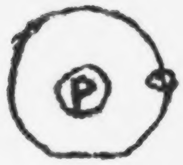
6. Have a child blow up a balloon until it breaks. What has caused this? As more and more air was put into the balloon, the air molecules bumped into other air molecules and against the side of the balloon until they broke the rubber.

7. Blow up a balloon, tie the end securely, and leave on a table for several days. Notice that the balloon begins to deflate. The molecules of the air went between the molecules of the rubber and escaped, deflating the balloon.

8. Air is matter. The air molecules that we breathe in are made up of a mixture of the molecules of the various gases in our atmosphere. When we breathe in the air, we utilize the oxygen in it, and breathe out carbon dioxide.

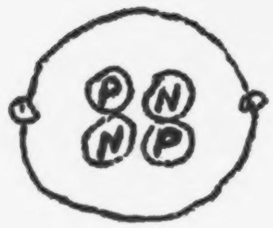
9. Have the children bring into the classroom examples of the common metallic elements: aluminum, copper, and iron. We must remember that alloys are metallic compounds; brass is a compound of zinc and copper, bronze is a compound of copper and tin, and that galvanized iron is a compound of iron and zinc.

10. Have several children read about and make reports on the simpler elements, such as hydrogen and helium. Have them draw simple diagrams to explain the parts of these atoms.
    Enrichment: Are atoms broken down into simpler parts? Have them answer questions such as these: what are protons, neutrons, and electrons? Where is most of the weight of the atom to be found? What is the electron shell of the atom?



Hydrogen atom: 1 proton in nucleus.
1 electron circling nucleus.

Atomic weight: 1 Atomic number: 1



Helium atom: 2 protons in nucleus.
2 neutrons in nucleus.
4 particles in nucleus.

2 electrons circling nucleus.

Atomic weight: 4 Atomic number: 2

Some of the children will begin to see the relationship between atomic weight and number.

11. Have the children make models of the hydrogen and helium atoms, using large overcoat buttons of different colors to represent the protons and neutrons and small buttons to represent the electrons.

12. Matter has weight and occupies space. Make a balance with baloons on either end. When the balloons are balanced, have someone break a balloon and see that the balloon filled with air is now heavier. (Remember the difference between mass and weight.)

13. Get a piece of aluminum foil or copper foil; cut this into halves. Cut one of the halves into quarters, eighths, etc., until such a small piece is left that cannot be cut farther but is still perceptible. Ask the children to see with their imaginations that this piece of foil still is made up of untold millions of atoms.

14. Matter on the earth is in three forms: solids, liquids, or gases, Have the children name solids and liquids they can perceive and gases that they know. Since all matter is made up of combinations of atoms (Molecules), what about the molecules in a solid, liquid, or gas? Get ice cubes (solid) and have them melt into liquids; get a pan and boil the water into a steam (gas).
The children should get the concept that in a solid, the molecules are close together and moving; that in a liquid, the molecules are farther apart and in faster motion; and that in a gas, the molecules are spread still farther apart and in more rapid motion than in a solid or a liquid state.

15. Water is a chemical compound composed of two atoms of hydrogen and one atom of oxygen. These two atoms of hydrogen and one atom of oxygen form a molecule of water. (Note: Helium and neon, inert gases (or gases that will not chemically combine with any other elements), are unusual in that the atom and the molecule are composed of only one atom. In other words, a helium atom is a helium molecule; a helium molecule is a helium atom.)

16. Molecules may be invisible, but we can smell some of them. Cut an onion in half; put one half into a shoe box and cover it. Place the other half on the table. Gradually the entire room will smell of onions. Now open the box that contains the other half of the onion and smell. The smell of things is caused by the chemicals they contain. These chemicals, as everything in our world, consist of countless tiny molecules. These molecules escape into the air. They have to reach our nose or we could not smell them.

17. Molecules may be invisible but we can taste some of them. Place some water into a pot and add a tablespoonful of sugar. The sugar will disappear; we say that it has dissolved. Taste the water; it will taste sweet.
When the sugar dissolves into the water, it falls apart into its molecules. The molecules begin to move into the spaces between the water molecules which are in continuous motion themselves. Finally, the two kinds of molecules become uniformly mixed so that the top of the water will have the same sweetness as the bottom. You may heat the sugar solution slowly until the water evaporates; you will find the solid sugar at the bottom of the pot. This is an example of a physical change.

18. Although molecules, which are made up of atoms in definite combinations, are invisible, we can still see them move. Pour some water into a glass and add a drop of red ink; the ink will spread in all directions and, after a while, will give a uniform pink color to the entire water in the glass.
The drop of ink, just as a drop of water, is made up of millions and millions of tiny molecules that keep moving in all directions. When the ink is dropped into the water, you can see the ink molecules move in all directions, because their red color spreads among the colorless water molecules.

19. The ocean is a mixture of many elements and compounds. Scientists have learned to extract some elements and compounds from the sea. Iodine, bromine, and magnesium are elements that have been extracted chemically. Salt, a compound, can be obtained by the evaporation of sea water.

20. Dissolve salt into a glass of water. When the salt dissolves, the solid salt changes into a liquid. Although the salt has changed its form, it will still be salt. We can be sure of this by tasting the water; it now tastes salty.
When the water evaporates, we get the salt back into a solid crystal form. The changing of the salt from a solid into a liquid and back to a solid again is called a physical change. The salt remained salt; only its form became different. The molecules that made up the salt retained their characteristics.

21. The distillation of water is a physical process. Put three cups of water and three tablespoonsfuls of salt into a tea kettle. The water is now undrinkable.
Attach one end of a long rubber hose to the end of the teakettle and put the other end into a glass. The glass is set on a pan filled with ice cubes.
Heat the teakettle on a hot plate. The water (liquid) changes to a vapor (gas); the water in the kettle begins to evaporate. The rubber hose takes the vapor into the cooled glass and the cooling makes the water vapor condense to liquid water.
The water in the glass is again drinkable; the salt has remained in the kettle.
The process of heating a liquid to change it to a vapor and cooling the vapor to change (condense) it into a liquid again is called distillation.

22. Look at salt crystals under a magnifying glass; notice its crystalline structure. This is due to the pattern of the salt molecules; salt is a chemical compound made up of the elements sodium and chlorine. Sodium is a metal and chlorine is a gas; one sodium atom joins up with one chlorine atom to make up a salt molecule.

23. Breaking a match stick up into slivers is a physical change; cutting a piece of paper into smaller bits is a physical change. We have changed the size of the wood and the paper but they still remain wood and paper.
Burn the match stick on a plate; burn the paper on a plate. Whenever anything burns, a chemical change takes place. Whenever anything burns, it combines with the oxygen in the air to form a new compound.

24. Get a nail; wrap it in moist paper, making sure that the paper is kept moist, and notice the rust that accumulates after several days. The rust is a chemical compound of iron with the oxygen in the air, iron oxide.

25. The sugar molecule is a chemical combination of the atoms of the elements of carbon, hydrogen, and oxygen. When the carbon, hydrogen, and oxygen are chemically combined in the right amounts, they form ordinary table sugar. This sugar is a compound; it is not like the carbon, hydrogen, and oxygen that make them up.
Put some sugar on a spoon; heat the sugar with a candle underneath the spoon. Hold a knife above the spoon and notice the moisture forming on the knife; this is the hydrogen and oxygen. The black char that remains on the spoon is the element carbon.

26. Mix iron filings and powdered sulphur on a plate and stir thoroughly. Now get a magnet and remove the iron filings from the mixture. This can be done because the molecules of iron and sulphur have retained their physical characteristics.
Mix the iron filings and the sulphur again in a test tube and heat the test tube. Now we have the chemical compound, iron sulphide. A magnet cannot now remove the iron from the sulphur. This is an example of a chemical change.

FILMS

#18 Molecules and Atoms	397.01	Phila. Suburban Film Library
#19 Molecules in Action	397.01	" "
Properties of Gases	1126	
Properties of Liquids	1126.01	
States of Matter	1328	
Things Dissolve	1386.01	

FILMSTRIPS

What Things Are Made Of	427-20	Society for Visual Education, Inc.
Chemical Changes	427-21	" " " " "
Atoms and Molecules	427-22	" " " " "
Understanding Chemical Change		McGraw-Hill Book Co.
How Things Change		" " "

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LOWER MERION SCHOOL DISTRICT GRADE 5

HEAT

Heat is a necessary part of a child's environment every minute of every day. The main purposes of this unit are to make the children aware of the vital role of heat in their lives, to acquaint him with some of the physical properties of heat, and to describe some of the ordinary daily events in his environment which depend upon heat.

CONCEPTS

Heat can make solids expand. (1-2-3-4-5-11)
Heat can make liquids expand. (6-7-11)
Heat can make gases expand. (8-9-10-11)
WHEN A SUBSTANCE IS HEATED IT EXPANDS.

We explain heat as the energy of moving molecules. (11-12-13-14-15-16-17-18
All molecules on our earth are in motion. (19-20-11)
Friction is movement, producing heat. (16-17-18)
HEAT IS PRODUCED BY MOTION.

Plants need heat to sustain life. (21-24)
Animals need heat to sustain life. (22-23-25)
ALL LIVING THINGS NEED HEAT.

MATERIALS

4 Corks
1 Candle
1 Crayon
Blue Ink
Red Ink
Water
Strips of thin paper or cloth
Window Pole
2 ThermOmeters
2 Milk Bottles (quarts)
3"x5" piece of oak tag
1 Onion
1 Thumbtack
1 Large Wood Screw
1 Screw Eye
1 Crayon
2 Dowels
1 Strip Iron (1"x6")
1 Strip Brass (1"x6")
Several Tacks
1 Small Nail
8' Wire
Corkscrew
3 Medicine Bottles
8 Glass Tubes
2 Jars
4 Stoppers (clay can be used in place of the stoppers)
2 Large dishes
1 Pyrex Baby Bottle or a coke bottle
1 Basket Ball
Soap

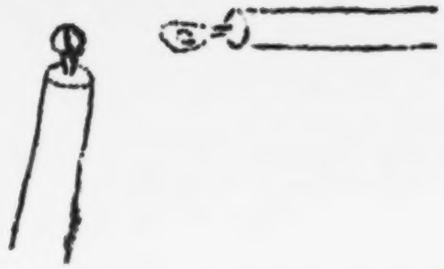
TEXTBOOKS

1 - 4 : 94-105
1 - 5 : 24-43; 84-86; 122-126; 204-206
1 - 6 : 4-27; 30-35; 210-214; 219-224
2 - 4 : 50-51; 109-111; 112-127; 234-236
2 - 5 : 38-49; 57-81
2 - 6 : 97-98; 292-296; 329-334
3 - 4 : 103-122; 130-133
3 - 5 : 59-61; 67-68
3 - 6 : 36-43; 138-139

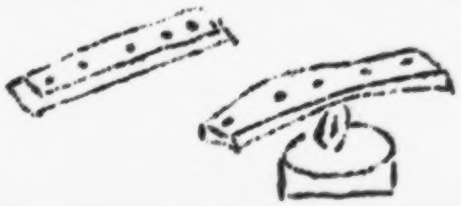
ACTIVITIES

1. How long is the Walt Whitman Bridge? That depends .....
   How high is the Penn Center Building? That depends .....
   It depends on temperature. A bridge, a building, and everything else in the world changes size with a change in the temperature.

2. Secure a large wood screw and a screw eye; the head of the screw must go through the screw eye. Screw each one into the head of a dowel, letting at least 3/4" of the metal protrude. Heat the head of the screw in a flame for a while and then try to put it through the screw eye. Keep the screw hot and heat the screw eye in the flame at the same time. Now try to put the screw head in through the screw eye. Keep the screw head in the flame. Cool the screw eye in the cold water. Again try to put them together. Next cool the screw head and try again.



3. Two strips, of iron and brass, riveted together will bend when heated because of the difference of expansion. Make the holes with a nail and use small tacks as rivets. Another way of fastening the strips together is cut them with projections of equal intervals and bend them over to interlock.

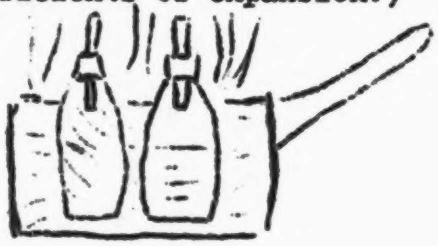


(Old thermostats would be an excellent source of bimetallic strips already made up. See a local heating contractor.)

4. Things to discuss- Expansion joints in railroad tracks, (One mile of railroad track may be four feet longer on the hottest day of summer than the coldest day of winter.) sidewalks, and highways. Why do we run hot water over a jar lid to get it open?

5. Heat makes solids expand, cold makes them contract. Stretch a wire tight between two chairs over a table. Hang a corkscrew on the wire and observe how far it hangs down. Heat the wire with a lighted candle and watch the corkscrew approach the table as the heat makes the wire expand. Let the wire cool. The wire will become shorter and the corkscrew will go back to its original position.

6. Fit two or three medicine bottles with corks and put tubes through corks. Fill them with different liquids and immerse them in a pan of hot water. The rise inside the tubes indicates difference in expansion. (If the diameter of the tubes is known, and the capacity of the bottles, it is possible to calculate the apparent coefficients of expansion.)



7. Fill a jar with water and add a few drops of blue ink. Put a glass tube through the stopper and stopper the jar. (Be sure to moisten the stopper and the tube. Clay could be used in place of the stopper.) The tube should should project upward about 2 inches. The colored water will rise in the tube. Mark with a crayon the water level in the tube. Now place the jar in a dish of hot water. The water level in the tube will be higher. Place the jar in a dish filled with ice. The water level in the tube will drop.

8. Snap a balloon over the neck of an empty bottle. The bottle is not really empty of course. It is full of a mixture of gases--air. Place the bottle on a warm radiator or in a basin of warm water, to warm the air in the bottle. Observe.

9. Partially inflate a balloon or a basket ball. Hold the balloon or ball over a hot plate for a while and observe the results.

10. A soap bubble stretched over the neck of a medicine bottle will grow larger if warm hands are placed on the bottle.

11. Interest a pupil in making a report on the scientific value of Count Rumford's experiments with heat. (Lewellen, John, The Boy Scientist; Comptons Pictured Encyclopedia; World Book.)

12. Interest advanced pupils in reporting on "kinetic" theory of matter (World Book Encyclopedia; Comptons Pictured Encyclopedia, dictionary, etc.) including etymology and related words; e.g, kinesthetic. Relate to movement of air in the classroom. (Tie some strips of paper or cloth to the end of a window pole. Open one of the windows in your school room at both the top and the bottom. Hold the strips near the top opening of the window. Does the air move in or out? Now hold the strips near the bottom.)

13. Get two thermometers. Hang one up near the ceiling and place the other near the floor. In a few minutes read both thermometers.

14. Discuss the ventilation system in your classroom. Where does the warm air enter the room? Where does the cold air leave the room?

15. Color a quart of hot water with red ink. Fill a quart milk bottle with the colored water. Fill another quart milk bottle with cold water that has not been colored. Put a card over the mouth of the bottle with the cold water in it. Turn this bottle upside down, holding the card tightly in place, and put it on top of the other bottle. Then pull out the card slowly. Notice how fast the water in the top bottle gets red.

16. Put a thumbtack in the center of the top of a cork. Touch the thumbtack to your lips. It will feel cool. Hold the cork, and rub the head of the thumbtack against a sheet of rough paper. Rub it back and forth at least twenty-five times. Touch the head of the thumbtack to your lips again. It will feel warm.

17. Have the children rub their hands together briskly. Observe the results.

18. Discuss how a scout produces fire by rubbing two sticks together.

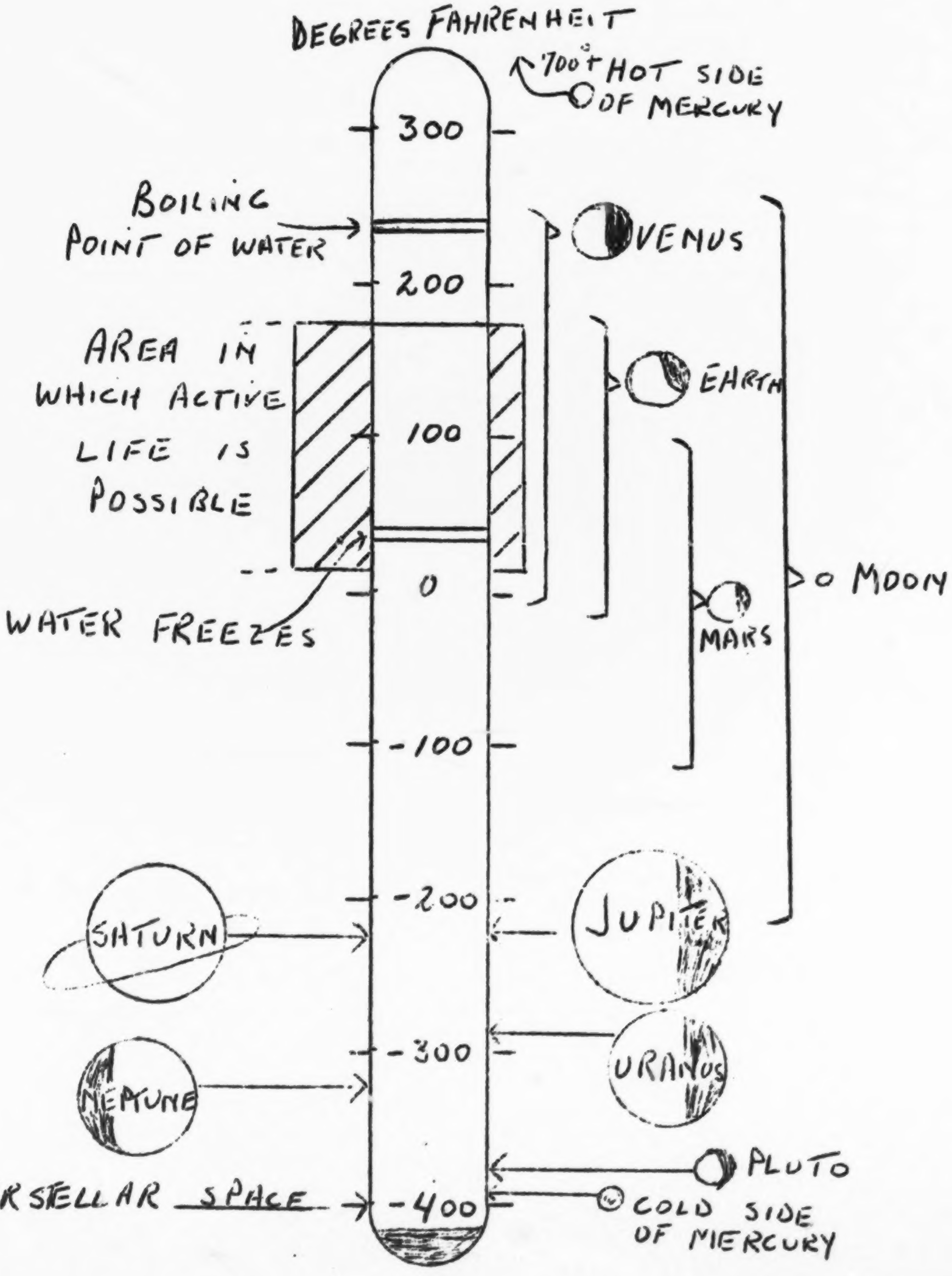
19. Use a drop of ink and a glass of water in this experiment. (A drop of ink is made up of many molecules.) With a medicine dropper, place a drop of ink on the surface of the glass of water. Watch it move slowly in all directions, until it has colored all the water.

20. Cut an onion in half. Place both pieces on a table in front of the room. Now sit back and wait. Sniff for the smell of onions! Let each person raise a hand as the odor reaches him. Does everybody smell the onion at once, or does the smell travel, bit by bit? This is what happened. Some of the molecules from the cut onion moved into the air. Diffusing out through the air, they reached the nearest noses first.

21. One of the most important requirements of life on earth would seem to be an equable temperature. The range of temperature that allows for active life is very small--approximately from 20 degrees F. to 140 degrees F. (Most living things exist in a temperature range between 32 degrees F. and 120 degrees F. However, pollen grains and some seeds have been cooled to 450 degrees F. and recovered normal activity.) The upper temperature limit is the more important for if the temperature is too high, the complex molecules upon which the chemical activity of life seems to depend begin to break up. The lower limit is much less definite for life may, at low temperatures, assume a latent form. To observe the effect of heat on plants: in the beginning of the school year assign each child one twig on a certain tree on the school grounds. Allow them to report their observations to their classmates throughout the year. (A living laboratory.)

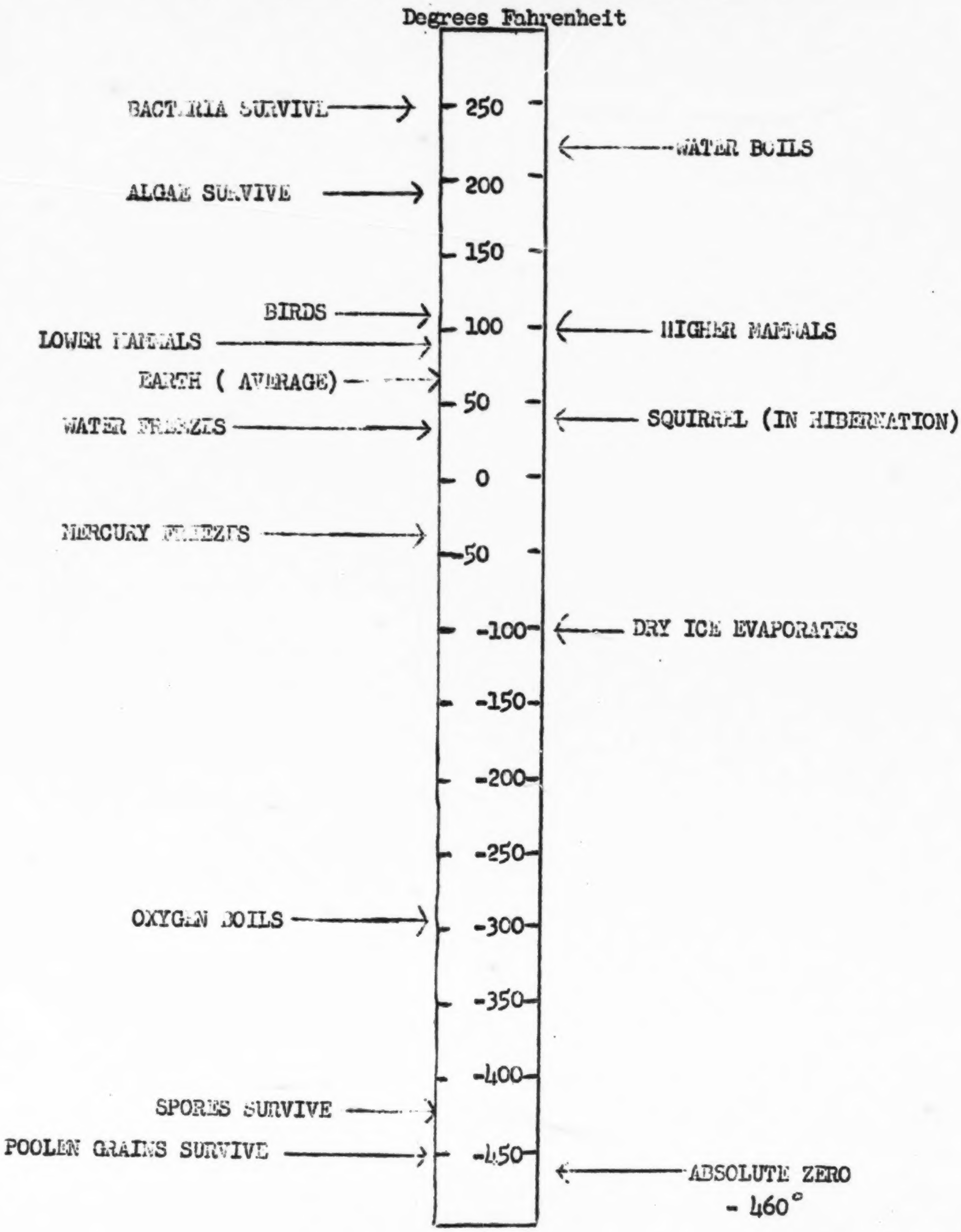
22. Place this drawing in an opaque projector.

TAKING A PLANET'S TEMPERATURE


DEGREES FAHRENHEIT
700°+ HOT SIDE OF MERCURY
300
BOILING POINT OF WATER
VENUS
200
AREA IN WHICH ACTIVE LIFE IS POSSIBLE
EARTH
100
0
WATER FREEZES
MARS
MOON
-100
-200
SATURN
JUPITER
-300
NEPTUNE
URANUS
PLUTO
INTERSTELLAR SPACE
-400
COLD SIDE OF MERCURY

23. Place this drawing in an opaque projector. Discuss

SOME PRIMARY (LOW) AND CRITICAL (HIGH) TEMPERATURES



24. The florist can keep flowers alive in cold weather only by changing their natural environment. Discuss. How do the perennials survive a cold winter? Perennial plants, except trees and shrubs, die down to the ground during the winter. Then in the spring they start to grow again. (Some of the common perennials are bleeding heart, tulip, iris, phlox, primrose, narcissus and delphinium. Most kinds of grasses that we use for lawns are perennials.)

25. What do animals do in cold weather in order to survive? (Some animals hibernate, some migrate, other animals grow a heavier coat of fur. Man wears heavier clothing or influences his environment by burning fuel to keep warm. The purpose of clothing is to keep the wearer comfortable in the particular environment in which he happens to be. Because cloth is a poor conductor of heat, most of our clothing is made from it. Clothing will not conduct the heat from our bodies away from us.) Animals adapt to their environment. Man can change or modify his environment.

RESOURCE PEOPLE

School Custodian
Heating Contractor

RESOURCES

New building under construction to observe the installation of the heating units.

FILMS

Air All About Us	Philadelphia Suburban Film Library
Energy	"
How Does Heat Travel	"
What is Energy	"

FILMSTRIPS

The Air About Us	SVE, Inc., 1345 Diversey Parkway, Chicago 14, Ill.
Energy Unlimited	"
Heat and How It Is Measured	"

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World Book Encyclopedia

LOWER MERION SCHOOL DISTRICT GRADE 5

ANIMALS

This unit should mold previous concepts about animals established in earlier grades and should help the child recognize the logical arrangement of various animal groups according to their body structure. It should instill in the child a feeling for the orderliness of living things.

CONCEPTS

Animals have different body coverings (fur, feathers, etc.). (1)
Animals locomote in various ways (run, fly, swim, etc.). (2-7)
Animals eat different types of foods (carnivorous, herbivorous, omnivorous). (3)
Some animals have a backbone. (4)
Some animals do not have a backbone. (5)
ANIMALS DIFFER IN SOME WAYS.

Animals grow (constantly change). (6-30-31)
Animals move from place to place as well as internally. (7-2)
Animals eat. (8)
Animals produce more of their kind. (9-29)
Animals breathe. (10)
All animals are made of cells (basic unit of life). (11-12)
ANIMALS ARE ALIKE IN SOME WAYS.

Some likenesses of fish are fins, gills for breathing cold blooded, two-chambered heart; most have scales. (13)
Amphibians (frogs, toads, salamanders) breathe with gills early in life, develop lungs later, have smooth skin, are cold blooded, have three-chambered heart, and if they have toes there are nails or claws present. (14)
Some likenesses of reptiles are (snakes, lizards, turtles crocodiles) skin has scales, claws (if toes are present), lung breather, cold blooded, three-chambered heart. (15)
Some likenesses of birds are feathers, hollow bones, lung breather, warm blooded, four-chambered heart. (16-17-18)
Some likenesses of mammals are hair covering (thickness varies greatly) milk glands to feed young, lung breather, warm blooded, four-chambered heart, and their young are born alive. (19)
Fish, amphibians, reptiles, birds, and mammals also possess a backbone sometimes called a vertebral column, hence the name vertebrate. (20)
Sponges (hole bearing), jelly fish and corals (hollow body cavity), worms (flat, round, and segmented), oysters and clams (soft bodied), crayfish and insects (jointed appendages), are all animals that do not have backbones. They are called invertebrates. (21-29)
STRUCTURAL LIKENESSES ARE USED IN CLASSIFICATION.

Animals are used for food. (22-23)
Animal products are used for clothing. (24)
Animals help control numbers of plants and animals. (balance of nature). (25)
Animals are used in recreation. (26)
Animals are used in the medical field. (27)
The animal man does much to interfere with nature's balance (buildings, roads, airports, auto accidents, etc.). (28)

ANIMALS ARE USED IN A VARIETY OF WAYS.

MATERIALS

- Pets
- Aquaria
- Earthworms
- Frogs and tadpoles
- Wool cloth
- Grasshoppers
- Fish
- Clam or oyster
- Salamander
- Pearl button (from oyster shell)
- Baby chick or duck
- Snails
- Microsope and slides
- Silk cloth
- Fur coat or collar

TEXTBOOKS

1 - 4 : 145-163
1 - 5 : 140-161; 226-269
1 - 6 : 76-97; 145-163
2 - 5 : 83-105
3 - 4 : 19-37; 183-196
3 - 5 : 11-43
3 - 6 : 256-269

ACTIVITIES

1. Bring in pets. Observe body coverings on dogs, cats, birds, turtles, etc. Insects can also be collected. Do the body coverings vary? Why? Discussion should include protection and adaptation to specific environments.

2. How do animals move from place to place? Have students relate that birds, insects, and some mammals fly; most animals are land (terrestrial) forms; and that there are some aquatic (fresh water) and marine (salt) water forms. The students should also point out that some animals can run on land and also swim (amphibians).

3. Ask students what they feed pets. Do all animals eat the same type of food? E.g., feeding time at home and at the zoo. Bring in terms carnivorous (meat eaters) (discuss teeth structure), herbivorous (plant eaters), and omnivorous (eats plants and animals). Into which group do you fit? How is food obtained by animals?

4. Have a whole fish or chicken brought to class. Locate backbone. The children can locate backbone on each other. Study animal skeletons, if available. These animals are classed as vertebrates.

5. Earth worms, insects, clams, etc., can be brought in and examined for a backbone. The absence of a backbone means they are invertebrates.

6. Have a young chick, duck, etc., brought into classroom. Measure height, length, and weight. Send home for safe keeping and have returned in a week or two to repeat measurements. Children with baby brothers and sisters can bring in their measurements by the month. Growth means continuous change.

7. Locomotion - speeds of various animals are usually functional. Carnivorous animals depend on stealth and speed. Herbivorous animals need speed to outrun natural enemies. Some animals have protective devices: hides of reptiles (alligators and turtles), porcupine (quills), skunk (odor), protective coloring (mimicry, camouflage, counter shading, etc.).

8. Observe classmates eating in cafeteria. Note variety of food consumed.

9. Look for young grasshoppers, bird nests with eggs, pets with young. Ask children if they have babies in their homes. Discuss similarities, not necessarily looking exactly alike.

10. Observe a classmate breathing. Why do we breathe? Rates vary with the speed that food is burned. Rapid breathing is to remove excess carbon dioxide not to get additional oxygen.

11. Use microscope to see cells in animals; use prepared slides of blood cells or skin.

12. Wrap a gold fish with moist cotton and place tail fin under a microscope. Blood can be seen and possibly individual cells can be observed. Fish should be returned to tank after 15-20 minutes.

13. Have children give the characteristics of fish: long and narrow (less resistance to water), breathe with gills, most have scales, fins for locomotion and a backbone is present. The one structural feature that should be imparted to the children is that fish contain a two-chambered heart. How are fish useful?

14. Are there any animals that live on land and in water? Example, frogs are called amphibious which means double life. Toads and salamanders also are amphibians. Amphibians' skin does not have scales. They are vertebrates. If they have toes, they don't have nails or claws. In their early water life frogs breathe through gills. When they become adult they develop and use lungs; the gills will gradually disappear. Have frog eggs or tadpoles brought in to the classroom, if possible. Follow their development. Amphibians have a three-chambered heart and are cold blooded. Are amphibians useful animals? How?

15. Who can tell what a reptile is? After discussion try to organize general characteristics, such as, they are vertebrates; their skins have scales, if they have toes, claws are present. Many people confuse amphibians and reptiles.** Discuss some examples in detail or have children give reports. Reptiles have a three-chambered heart and are cold blooded. Why are reptiles important? Poisonous snakes and treatment may be considered. Many people die from shock or are literally scared to death when bitten. It is important not to be deathly afraid of all snakes; consequences may be very undesirable.
**Lizards, snakes, turtles, and alligators are reptiles.

16. What is a bird? Animals with feathers, wings, have a backbone, a four-chambered heart, hollow and strong bones, are warm blooded, and breathe with lungs. Feathers are outgrowth of skin as are the scales of reptiles. Birds have beaks and feet specially for their environment; e.g., ducks have webbed feet for swimming and spoon bill for sifting sediment on bottom of ponds. Not all birds fly. Individual reports may bring out the many differences of birds and also their importance to man.

17. Class may take a bird hike. How many birds can the children recognize by sight? By bird calls?

18. Some facts of how many insects a birds eats daily may leave a lasting impression why we must protect bird life.

19. Name five mammals. What do they have in common? They have a backbone, lungs, a four-chambered heart, a covering of hair (fur), are warm blooded; most of them live on land. The young are born alive and are fed from milk glands (mammary). Can be discussed and reported on as egg laying, pouched, hoofed, insectivorous, aquatic and marine, upright, etc., mammals. This may help to show the many varied forms of mammals. Adaptations may be discussed at length.

20. If possible, have students bring in fish, frog, toad, salamander, lizard, alligator, bird, dog, cat, etc., and see if they realize that they are all vertebrates (animals with backbones).

21. Have students discuss animals without backbones. Ameba (microscopic), sponges, jelly fish, worms (flat, round, and segmented), oysters, clams, and insects are examples of invertebrates. Examine an earthworm as a typical invertebrate (animal without a backbone) and try to secure other forms. Insects have a hard outer covering (exoskeleton) which should not be confused with a backbone.

22. What is your favorite kind of meat? Are cows, pigs, chickens, etc., different today from what they were a hundred years ago? Discuss breeding for specific purposes.

23. Exotic dishes: fried grasshoppers, chocolate covered ants, rattlesnake meat, etc. Students may discuss dishes (foods) they have tasted that are not commonplace.

24. Is anyone wearing an article of clothing that is made from an animal? Silk, wool, leather, pearl buttons, fur coats, etc., are a few examples.

25. Balance of nature can be taught when mentioning eating habits and numbers of certain kinds of animals present on our earth. Insects eat plants, birds eat insects, cats eat birds, etc. Man has done a great deal to disrupt this balance of nature.

26. Animals and recreation: horses, dogs, hunting, fishing, etc.

27. How have animals helped in our conquest of disease? Laboratory animals enable us to develop new drugs and protective medicines. Use animals for outer space travel to see how it affects their bodies. Monkeys used quite often because of structural likenesses to man. Laboratory animals can produce many generations in a short period of time. This is important in some experiments.

28. Man killing man, wars, murders, traffic accidents, etc. Medical research is prolonging the life of more people; e.g., average life span in 1900 was 50 years; in 1959, 70 years.

29. Look for cocoons on trees and bushes. Keep them to find out what comes from them.

30. Have an exhibit of baby pets.

31. Find some young grasshoppers. Put them in a cage and feed them grass. Watch what happens when they grow.

RESOURCES

1. Academy of Natural Sciences, 19 & Parkway, Phila. 3, Pa. Call: James A. Fowler, RI 6-7622. Admission charge 20¢ per person; museum guide 25¢. Tour takes one hour.

2. Norristown Zoo, Harding Blvd., Norristown, Pa. (picnic area available) or The Philadelphia Fairmount Park Zoo, Phila., Pa.

3. Farm: Philadelphia High School of Agriculture and Horticulture, Henry Avenue, south of Shawmont, Phila. 28, Pa. Call: Bertram L. Lutton, Principal, Ivy-Ridge 3-3200 (call in advance).

RESOURCE PEOPLE

1. Veterinarian 2. Game Warden 3. Entomologist

4. Zoo personnel

GRADE 5

FILMS

Beach and Sea Animals	(Radnor Film Library)
Beetles	"
Life in a Drop of Water	"
Pond Insects	"
Snakes	"
Game Conservation	Quebec Tourist Bureau 48 Rockefeller Plaza, N. Y. 20, N. Y. (book 3 months in advance, film is 53 minutes in length - color)
Cottontail	University of North Carolina Bureau of A. V. Ed., Box 1050, Chapel Hill, N. C. (28 minutes in color)

FILMSTRIPS

Frogs, Toads, Turtles - How They Grow	(SVE)
Snakes and Lizards You Should Know	"

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(Any good high school biology textbook)

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LOWER MERION SCHOOL DISTRICT GRADE 5

DISEASE CONTROL AND PREVENTION

The purposes of this unit are to help the children become better informed about contagion and how easily germs and disease spread, to show the children how they can help hinder the growth of germs, and to make the children aware that medical progress has been acheived by the efforts of many men over a period of centuries.

We count on the discretion of the teacher in presenting this material since some of the concepts can be frightening if overemphasized.

CONCEPTS

Germs are a tiny part of a world of tiny living things called microbes. (1*-2-61*-63*)
Germs have different shapes. (3-4-5*-13)
Microbes are tiny plants and animals that are all around you but you cannot see them without the aid of a microscope. (2-3-6*-7*-13-63*)
It would take a million germs to cover the period at the end of this sentence. (7*)
GERMS ARE TOO TINY TO BE DETECTED BY THE NAKED EYE.

Germs multiply by dividing. (8*-9)
Germs usually grow best in wet places, dark places, and warm places. (10*-11)
Each tiny microbe divides into two smaller microbes. (8*-9)
Microbes may grow to full size in less than half an hour, the each one divides again. (9)
Billions of germs can be produced in less than a day. (8*-9)
UNDER IDEAL CONDITIONS GERMS MULTIPLY RAPIDLY.

Germs may enter the body in the water we drink. (12*-13-14-15-32-33-49*-59-60)
Germs may enter the body in the food we eat. (16*-17-18-19-29-32-80*)
Germs nay enter the body in the air we breathe. (20-21-22-29-32)
Germs may enter the body through open wounds or burns. (23-24)
Germs may enter the body through insect or animal bites. (25*-26-30-31-32-80*-67*-69*)
Germs may enter the body by putting soiled objects in the mouth. (27*-28-29-30-31-32)
THERE ARE MANY WAYS THAT GERMS ENTER THE BODY.

Vaccines have been developed to prevent diseases. (34*-35*-41-43-62*-73*-74*-75*-76-77-78)
Serums have been developed to prevent disease. (37*-38*-41-43-68*)
Scientists have discovered various drugs to kill disease germs. (14-40*-41*-42-43-71*-72)
White blood cells fight disease germs. (34*-39*-66*)
WE HAVE MANY WAYS TO FIGHT GERMS.

*These numbers refer to items under Activities and Data that provide facts for the teaching of the concept. Teachers judgment as to the appropriatness of some ideas for a class should determine when they should be used.

Germs in water can be killed by a chemical. (49*-56*)
Germs in water can be killed by sunlight. (50*-56*)
Germs in water can be killed by spraying. (51*-56*)
Germs in water can be killed by boiling. (52*)
DISEASE GERMS IN WATER CAN BE KILLED IN A NUMBER OF WAYS.

Water pollution may be caused by household wastes. (53*-57*-58*-80*)
Water pollution may be caused by industrial wastes. (54*-57*-58*-80*)
Water pollution may be caused by wastes from soil flow-off. (55*-57*-58*-80*)
WATER POLLUTION CAN BE CAUSED IN MANY WAYS.

Microbes observed for the first time by a Dutchman. (61*-79)
Smallpox vaccination used for the first time by an Englishman. (62*-79)
Germ theory of disease acheived by a Frenchman. (65*-79)
Germ theory of disease related to people by a German. (65*-79)
Antiseptic surgery introduced by an Englishman. (64*-79)
Function of white blood cells proved by a Russian. (66*-79)
Cause of yellow fever discovered by an American. (67*-79)
First antitoxin discovered by a German. (68*-79)
Cause of malaria identified by an Englishman. (69*-79)
Serum against whooping cough developed by a Belgian. (70*-79)
Discovery of pencillin made by a Scotsman. (71*-79)
Discovery of streptomycin by an American. (72*-79)
Live polio viruses cultivated for the first time by a group of Americans. (73*-79)
Anti-yellow fever vaccine developed by a South African. (74*-79)
Introduction of the first polio vaccine by an American. (75*-76*-77*-79)
Oral vaccine developed by an American. (78*-79)
MANY MEN FROM MANY COUNTRIES HAVE HELPED FIGHT DISEASE.

MATERIALS

Boiled potato
Saucer
Microscope
Bioscope
Opaque projector
Stagnant water (small jar)
Bleaching water (small jar)
Cooked vegetable
Piece of bread
Piece of fruit
Atomizer
Apple
Six petri dishes or test tubes
Hot plate

package of unflavored gelation
Quart of boiling water
One half ounce boullion
Bouillon cube
Salt (pinch)
Soda (pinch)
Mosquito wrigglers
Oil (small jar)
Milk carton
Drinking glass
Sand
Gravel
Small beaker

TEXTBOOKS

1-4: 146; 206; 209; 237; 240-242;
1-5: 12; 148; 261;
1-6: 167-176; 257-276;
2-4: 159-160; 168-170; 206-209;
2-5: 315-316;
2-6: 145-146; 162-169; 229; 194; 197; 343;
3-4: 82; 164-165; 172-174; 213;
3-5: 24-28; 34; 145; 242-244;
3-6: 30; 95-117; 175; 180; 253-256; 289-292;

ACTIVITIES AND DATA

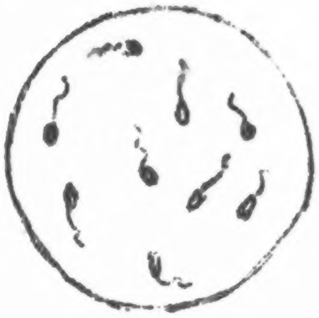
1.* Microbes are tiny plants or animals. Some branches of the microbe family are called bacteria, somo are called molds, some viruses, still others, protozoa. Most of the microbes are not harmful, many of them are helpful. All the harmful microbes that make people ill are called disease germs. When disease germs invade the body and are not killed by the white blood cells, they multiply and grow rapidly. As they feed and grow, they damage large numbers of body cells. At the same time they give off poisonous waste products called toxins. The toxins in turn, damage or kill more body cells. Even though a person can't see the germs causing the damage, he can feel their effect.

2. To observe bacteria; Place a piece of boiled potato on a saucer. This will be food for the bacteria. Let the food stand in the room for an hour or two. This will give time for the bacteria in the air to settle on the food. Then cover the dish and put it away in a warm place. In a few days look at the potato again. The round, smooth spots on the potato are colonies of bacteria. Each bacteria colony was formed from a single bacteria that fell on the food. The bacterium fed on the food, grew and divided, grew and divided, until it became a colony of many millions of bacteria. The bluish, fuzzy spots are colonies of molds. Molds are similar to bacteria, except that each mold plant is made of more than a single cell, while bacteria are single-celled plants.

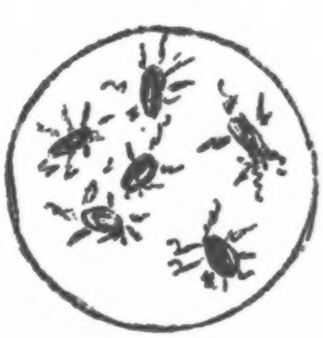
3. In looking at some bacteria through a microscope, one can observe that germs have different shapes. Some germs are tiny round balls clustered together. Some are spiral like a corkscrew, and others look like rods. But whatever their shape, all bacteria are alike in one way. Each bacterium is just one cell.

4. Have the children look for pictures of germs. Reproducc them with the opaque projector for classroom study. (Compton's Pictured Encyclopedia; World Book; Discovering Our World 3, Scott, Foresman.)

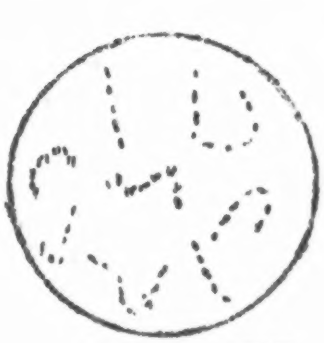
5.* Examples of disease germs.



CHOLERA



TYPHOID FEVER

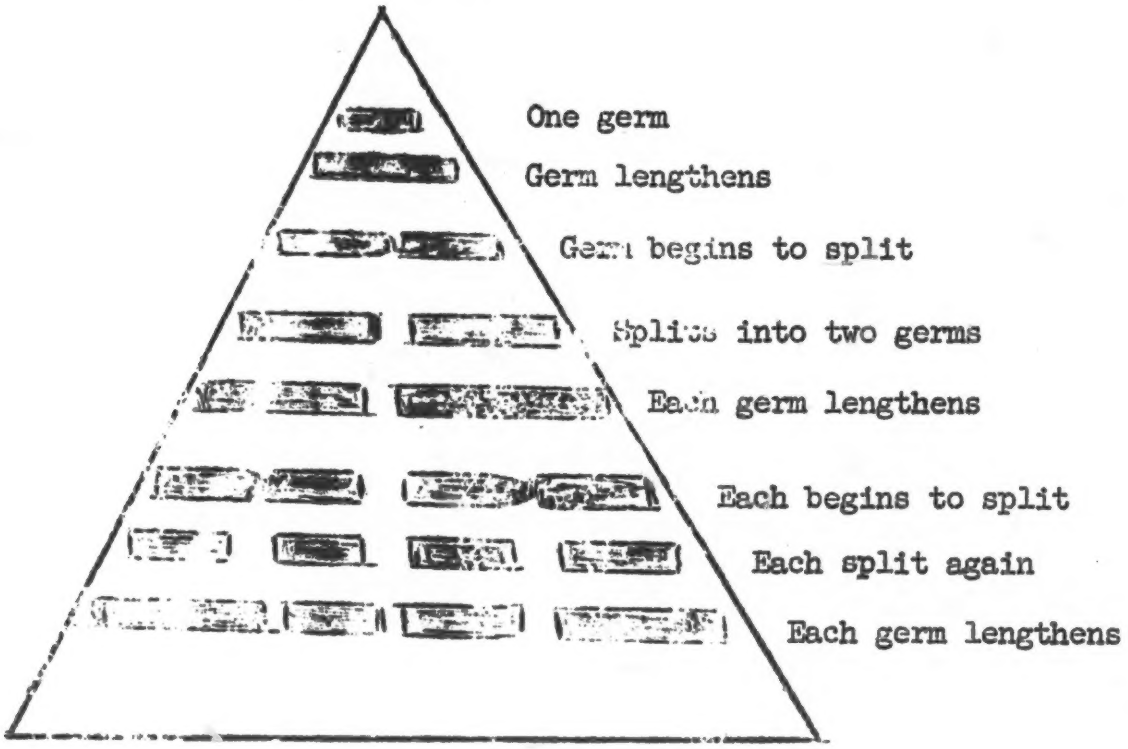


STREP THROAT

6.* Microbes are found all around us. In fact everything we touch has microbes on it, but we cannot see them because they are too small. Bacteria are found in more places than any other living thing.

7.* It would take about a million bacteria to cover the head of a pin. A pound of fertile garden soil may contain as many as fifty million bacteria.

8.* Diagram to show how germs multiply.


One germ
Germ lengthens
Germ begins to split
Splits into two germs
Each germ lengthens
Each begins to split
Each split again
Each germ lengthens

9. Have the children extend the following information.

HOURS	MICROBES
1/2	2
1	4
1 1/2	8
2	16
2 1/2	32
3	64

Billions of germs could be produced in less than a day.

10.* Germs are living things. They require food and a suitable environment in which to live. The human body contains substances some germs can eat. It also offers a suitable environment.

11. Discuss. Is it a good idea to allow left over food to sit on the stove for long periods of time even if it is covered? (Remember the ideal conditions for germs to grow.)

12.* One kind of disease germ that is water-borne causes typhoid fever. This germ lives in the intestines of people with typhoid fever. Another disease that may be spread by impure water is cholera. Today cholera occurs most frequently in Asia where untreated sewage is still dumped into many of the rivers. (India was the original home of the disease.) Dysentary is another disease spread by impure water. The most talked of epidemic of dysentary occured during the Chicago World's Fair in 1933.

13. Get some stagnant water from a quiet pool or ditch or from a vase in which flowers have been standing for several days. Put a drop of the stagnant water on a bioscope slide to see whether you have tiny animals swimming around.

14. Put a drop of bleaching water on the drop of stagnant water. Observe. (Bleaching water contains chlorine.)

15. Explain why this belief is inaccurate and might even be dangerous to the person who holds it: "You can tell by looking at it whether or not water is clean and safe to drink."

16.* Among the disease germs that may be food-borne are those of tuberculosis, diptheria, and septic sore throat. Food served at home or in restaurants may be contaminated by germs, if it is handled by people with unclean hands or fingernails, if it is not properly protected from flies, and if it is not properly packaged or stored to prevent spoilage.

17. Have the children make a chart of important guides for food handlers.

18. Topics to discuss: Have the children noticed any licenses posted in their community food stores or restaurants? Have any noticed the inspection stamp on the meat they buy? How are unwraped food in the food stores protected from dust and flies?

19. Growing microbes in food: put a piece of cooked vegetable, a piece of bread, and a piece of fruit in a dish. Leave the food in the open for an hour or so. Cover the dish and put it in a warm, dark place. After about two or three days observe the results under a microscope.

20.* Germs of some diseases such as the common cold, influenza, and chicken pox are air-borne; that is, they can be spread directly from person to person through the air.

21.* Millions of tiny disease germs that cause a cold go flying out in droplets of moisture from your mouth and nose when we sneeze. Many of these germs may linger in the air for half an hour or more.

22. Demonstrate by use of an atomizer how coughing and sneezing spread germs.

23. Open cuts or burns are like open doors to germs. Take care of a cut or burn at once. Wash off any dirt and cover the broken skin with a clean bandage.

24. Show how germs enter the body through a cut or burn by cutting a slit in an apple and putting some decaying part of another apple or mold in it. Observe the results after a few days.

25.* Dogs, cats, squirrels, horses, cattle, wolves and bats can carry the rabies germ. Rats have spread bubonic plague and typhus. Cows can carry the germs of tuberculosis and these germs may get into the milk supply. Perhaps the busiest carrier of germs in our country today is the house fly. Malaria and yellow fever are carried by mosquitoes.

26. Discuss the steps that can be taken by our community to control disease carrying animals and insects.

27.* The bad habit of putting fingers, pencils, pins, and similar things in the mouth may carry dangerous disease germs into the body where they can begin to grow. (Good opportunity to help break bad health habits.)

28. Make posters showing how careless personal habits spread disease.

29. Some suggested discussion topics:
How may dirty fingernails cause sickness?
Why should the hands be washed well before handling food?
Why are public drinking cups harmful?
What are the dangers of a community towel?
Name some health habits that may pootect us against germs.

30. Bacteria can be grown by following the directions in Discovering Our World 3, Scott, Foresman.
If petri dishes are not available it is possible to use test tubes or medicine bottles. (Science for Today and Tomorrow by D. C. Heath.)

31. To make a gelatin for a culture, prepare it the same way as any gelatin dessert. Use every effort to keep the material sterile.
One package of unflavored gelatin.
One quart of boiling water.
1/2 ounce of bouillon. (made with a bouillon cube.)
Pinch of salt.
Pinch of soda.

32. Have the class make a list of things to do to help control the spread of disease in their home, school or community.

33. Bring some mosquito wrigglers in water to school-pour some oil on these and notice the results.

34.* A vaccine is put into our body to keep us from getting a certain disease. The vaccine makes your body produce antitoxins. If disease germs get into the body, the antitoxins will make the toxins that the germs produce harmless. Then the white corpuscles in our blood will have time to kill the germs before they can multiply very much.

35.* Nearly all children in the United States are now vaccinated against diptheria, tetanus, whooping cough, and smallpox. Vaccines against typhoid, paratyphoid, typhus, and yellow fever; cholera; rabies; influenza; and now polio are available to the doctor.

36.* The first vaccine, that against smallpox, is still one of the most effective. It was discovered in England by Dr. Edward Jenner in 1796. The disease has been almost entirely eliminated by vaccination.

37.* Antitoxins are usually obtained from animals. First the animals are infected with a mild form of the disease. This causes their bodies to produce antitoxins to the disease. The antitoxins remain in the blood of the animals for a long time. At regular periods small quantities of blood are painlessly removed. The liquid part of the blood containing the antitoxion is separated and purified. When it is injected into a person, the antitoxin remains in the persons blood and prevents the disease from developing.

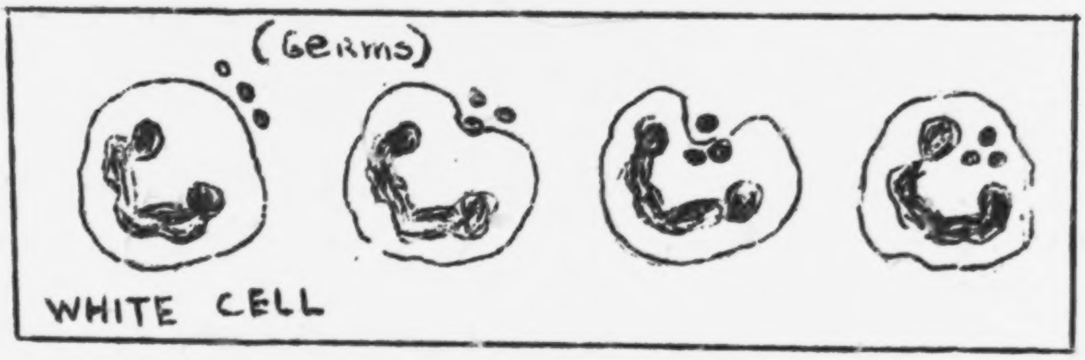
38.* Among the bacterial diseases for which antitoxins are available are diptheria, scarlet fever, tetanus, gas gangrene, and botulism. (food posioning)

39.* Whenever germs get inside your body, the white corpuscles gather at the place where the germs are. The white corpuscles are so small that they can pass out of the blood vessels and into the cells. When they get to the germs, the battle begins. The white corpuscles kill the germs by eating them. (Pus in a wound is dead white corpuscles.)

40.* Scientists have discovered various chemicals that kill disease germs. Chlorine is used for killing germs in the water of reservoirs and swimming pools. Sulfa drugs, penicillin, aureomycin, and terramycin are chemical germ killers that have been discovered in the past few years.

41. Vaccines, antitoxins, and germ killing chemicals are not just lucky accidents. They are the results of patient work by thousands of scientists over hundreds of years. Student reports on sulfa drugs, penicillin, and terramycin should reveal the vast amount of effort and devotion needed to make the discoveries that help man.

42. Reproduce with an opaque projector.



WHITE CELLS VS. GERMS

Picture shows how the white blood cells kill germs by eating them.

43. What reasons might there be for this great difference in average length of life? "A baby born in the developed areas of the world has a life expectancy of 60 to 70 years; a baby born in the underdeveloped areas of the world has a life expectancy of only about 35 years."

44. How should the children go about explaining to a friend the reason why he should go to a doctor for shots?

45. Discuss. Trend in the expectation of life at birth.

MALES	YEAR	FEMALES
35	1800	35
38	1850	41
46	1900	48
66	1950	71
67	1955	73

46. Let's pretend. Have the youngsters pretent they are going to tell something they know about microbes to their dad. What would they tell about?

47. Have a question box for the youngsters to submit questions about microbes.

48. A committee could find out which of their classmates have parents concerned with some aspect of health. For example are any of the parents doctors? Nurses? X-ray technicians? Dieticians? Cooks? Food inspectors? Sanitation workers?

49.* To make sure water is fit for drinking, germs are killed by adding small amounts of a chemical called chlorine. The small amounts of chlorine in the water are quite harmless for people to drink.

50.* Some germs can be killed by the ultraviolet rays in sunshine. Germ killing lamps are used in meat markets. Hospitals may use ultra-violet radaiation to keep air sterile in operating rooms and elsewhere.

51.* Germs do not live well in sunshine and freah air. When water is sprayed into the air, sunlight and oxygen kill many of the germs. Aeration or "airing" the water is also used to remove an unpleasant taste or smell from the water. Aeration is one of the methods used by water filtration plants to help make water fit to drink.

52.* Boiling water will kill any germs it may contain. (It wouldn't be practical for a city to boil all its water.)

53.* Some communities dump sewage and garbage into bodies of water nearby. Sewage contains all the waste materials that go down kitchen drains, bathtub drains, and toilets.

54.* Oils, acids, and greases are a few examples of harmful wastes released by factories.

55.* When soil is washed off the land by rain, it travels to streams and rivers. The soil may contain impurities that are harmful to humans. Muddy water is useless for home use and for many industrial purposes. Many kinds of fish can't live in muddy water.

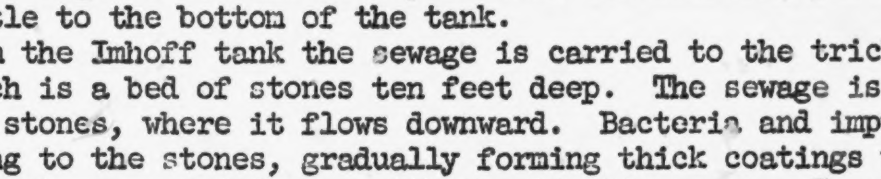
56.* Water filtration plant.
1. Water is piped from sources to the waterworks, or filtration plant.
2. The water is first treated with chlorine.
3. Other chemicals called coagulants are used to clear the water; then it is allowed to stand in great basins where most of the impurities settle out.
4. Next it is filtered through layers of sand and gravel.
5. The filtered water is then sprayed into the air, adding oxygen to it.
6. Finally, a second treatment of chlorine is ginen for extra safety.

57.* Sewage plants differ in different cities, but the main purpose of all of them is to kill harmful bacteria in the sewage and so make it fit to empty into lakes, rivers, or streams at safe distances from the cities or towns.

58.* In a typical plant the sewage first passes through a screen of metal bars. This screen catches large particles that might clog the sewer pumps. The sewage then flows into a shallow, concrete channel called a grit chamber. Here the sewage is slowed down and the heavier particles, such as grit and sand, settle to the bottom. Next it flows into a settling tank called an Imhoff tank. Here the sewage moves more slowly so that the floating particles can settle to the bottom of the tank.
From the Imhoff tank the sewage is carried to the trickling filter, which is a bed of stones ten feet deep. The sewage is sprayed onto the stones, where it flows downward. Bacteria and impure particles cling to the stones, gradually forming thick coatings which peel off and are carried away with the liquid sewage. To remove these coatings, the sewage is passed through a final settling tank where the coatings settle to the bottom. From this tank the liquid sewage is pumped through pipes to a body of water some distance away.

59. A water filter: punch many little holes in the bottom of a milk carton. Then pour in about three inches of gravel. On top of the gravel add three inches of sand. Rest the carton on a drinking glass and your filter is ready to use.
Pour muddy water on top of the sand. Let it filter through. How does the filtered water look?

60. If you do what is shown in the following diagram, you can purify dirty water.



GRADE 5

61.* Anthony van Leeuwenhoek (1623-1723) "Father - [illegible]oscopy"; first man to see a microbe. Believed by many to be the in[illegible]r of the microscope.

62.* Edward Jenner (1749-1823) Developed smallpox vaccination, the immunizing procedure, in 1796.

63.* Louis Pasteur (1822-1895) His germ theory of disease one of the greatest achievements of all time. He made many important discoveries about diseases caused by germs.

64.* Joseph Lister (1827-1912) Introduced antisepsis to surgery. (The process of inhibiting the growth and multiplication of microorganisms.)

65.* Robert Koch (1843-1910) Discovered tubercle baccillus in 1882; proved that specific infectious diseases are caused by specific microorganisms. Proved that bacteria can cause some of the diseases people have.

66.* Metchinkoff Elie (1845-1916) Showed how white blood cells destroy germs.

67.* Walter Reed (1851-1902) Headed U.S. Army Yellow Fever Commission in 1900 that proved cause of the disease.

68.* Emil von Behring (1854-1917) Discovered diptheria antitoxin, the first antitoxin.

69.* Sir Ronald Ross (1857-1932) Identified species of mosquito that causes malaria.

70.* Jules Bordet (1870-1961) Discovered whooping cough baccillus and developed serum against it.

71.* Sir Alexander Fleming (1881-1955) Discovered penicillin.

72.* Selman Waksman (born 1888) Discovered streptomycin.

73.* John F. Enders (born 1897) Headed group that cultivated live polio viruses making polio vaccines possible.

74.* Max Theiler (born 1899) Developed anti-yellow fever vaccine.

75.* Edward Tatum (born 1909) Shared in work of cultivating live polio viruses, making polio vaccine possible.

76.* Frederick Robbins (born 1916) Shared in work of cultivating live polio viruses.

77.* Jonas Salk (born 1914) Development of polio vaccine.

78.* Albert Sabin (born 1906) Development of oral polio vaccine.

79. Make up some "Guess Who? games about famous health heroes.

WHO WAS HE?

He was a German doctor.

He lived at the time of Louis Pasteur.

He discovered a good way to grow bacteria in a laboratory.

He was the first to discover the germs that causes tuberculosis.

He proved that bacteria can cause some of the diseases people have.

Who was He?

80.* Arrangements have been made to supply each fifth grade with the 1961 Annual Report, Board of Health, Lower Merion Township. You will find in here references to: general health, communicable disease control, public health nursing, environmental sanitation, and public health education.

RESOURCE PEOPLE

School Nurse
Local Doctor

RESOURCES

Board of Health, MI 2-3700. Contact Mr. Thomas.
Dairy
Food packing plant
Filtration Plant, Philadelphia Torresdale Plant, MU 4-8211. Mr. Dillener.
Sewage Disposal Plant, Haverford Township, HI 6-0867. Mr. Longley

FILMS

Common Cold	Philadelphia Suburban Film Library
Story of Dr. Edward Jenner	" " " "

Films for the Asking, catalog of health films. Pennsylvania Department of Health, Division of Public Health Education, Box 90, Harrisburg.

FILMSTRIPS

We Have You Covered	SVE
Health Heroes Series	Metropolition Life

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ELEMENTARY SCIENCE REVISION - 1962

EVALUATING THE UNITS

SIXTH GRADE

Gerald Craig wrote, "Science is a large subject. Thousands of scientific books have been written, yet man has only begun to make an acquaintance with his universe. Elementary science should be that which has a legitimate place in the elementary school. Therefore, a teacher need not be appalled by the extent and complexity of science as a whole; for she is responsible for imparting only a small portion of the sum total of scientific knowledge; namely, that portion which is pertinent to a group of children at a given age level."[1]

In the sixth grade the three major areas - Living Things ("The Human Body"); Non-Living Things ("The Universe"); and Energy ("Electricity," "Atomic Energy," and "Aviation") reach the end of the elementary spiral. The "Human Body" caps the story of animals and plants, "Atomic Energy" is the most recently discovered field in the world of energy, and "The Universe" climaxes a study of the earth's crust, the atmosphere, and the solar system. To the uninitiated, this might appear to be too much, for both the child and the teacher. If care is taken to keep the material within the scope of the child there is no reason why any interested, able and hardworking teacher cannot make science a tremendously rewarding area, both for himself and his children. It is being done, all the time.

The sixth grade evaluation sheets indicated that"Electricity,""Aviation," and "The Human Body" were enthusiastically received, "Atomic Energy" was difficult the first year but improved markedly the second year, and the "The Universe" tended to be intangible and beyond the scope of many of our children.

For this reason "The Universe" has been completely revised. A more detailed, specific, tangible study is offered. Teachers should be fully aware that more material is presented than they will probably use, but since many teachers apparantly feel ill prepared in this area, a great deal of background material is presented.

Because the health units are now developed from the first to the sixth grades, the sixth grade study of "The Human Body" has been revised and expanded to include all the major systems of the body.

Additional suggestions made for the "Electricity," "Aviation," and "Atomic Energy" units are also included on an accompanying sheet.

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[1] Science For Today's Children, Ginn, 1958, Pg. 87.

Additional Suggestions for Teaching the Units

ELECTRICITY

An electric train set up in the classroom can be used to supply much of the information to be gained.

Children may be assigned to read electric meters and learn how electric bills are determined.

AVIATION

A ten-cent glider made of balsa wood can be used for experimentation.

A study of famous aviators helps to personalize this unit.

The Lakehurst Naval Air Station may be added to the list of resources.

ATOMIC ENERGY

Mr. Arthur, from the General Electric Atomic Research division, is an excellent resource person.

THE HUMAN BODY

The kit on the human body from the Instructor has proved to be an extraordinarily helpful aid for this unit.

LOWER MERION SCHOOL DISTRICT GRADE 6

ATOMIC ENERGY

The objectives of teaching atomic energy at the elementary level are as follows: to create a real interest in learning about and discussing atomic energy; to teach some of the underlying scientific principles; to provide opportunity for the development of desirable attitudes with reference to getting along with others; to develop the constructive aspect of atomic energy and the importance of wise use of it.[1]*

CONCEPTS

Man has used wind and water as a source of energy. (1-4)
Man has used steam, gasoline and diesel engines as a source of energy. (2-4)
Man has used electric generators and motors as a source of energy. (2-4)
Man has used the atom as a source of energy. (3-4)

MAN HAS LEARNED TO USE MANY DIFFERENT SOURCES OF ENERGY, ONE OF THE NEWEST BEING THE ATOM.

Everything is made of small particles called atoms. (5-6-7)
The essential difference between the atoms of different substances lies in the number of particles they contain, the kinds of particles are the same. (8-9-10)
Protons and neutrons are found in a small dense nucleus of the atom; the electrons are arranged in orbits outside the nucleus. (8-9-10-11-19)

ATOMS ARE DIVISIBLE. THEY ARE COMPOSED OF SMALLER PARTICLES THAT INCLUDE ELECTRONS, PROTONS, AND NEUTRONS.

There are vast quantities of energy inside the atom. (12)
The splitting, or fission, of an atom results in the formation of new kinds of atoms. (13)
Some atoms, such as those of radium and uranium, split spontaneously; they possess natural radioactivity. (14)
In the hydrogen bomb, hydrogen atoms join to form helium atoms. This is called fusion, in contrast to the fission that occurs in the atom bomb. (15-16)
The energy of the stars is derived from atomic fusion. (16)

IN BOTH FUSION AND FISSION, SOME ATOMIC MATTER IS CONVERTED INTO ENERGY.

Atomic engines differ from other types of engines chiefly in the kind of fuel they use. (17)
The problem in the use of atomic energy is to release the energy so that it can be used, when needed, to run machinery. (18-20)
Radioactive atoms are useful in the fields of medicine, agriculture, and industry as tracers. (21-22-23)

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[1] Blough, p.440

GRADE 6

Progress is being made in the development of atomic energy for peacetime use. It may be used as a fuel for space travel. (17-18-25-22)

THE ENERGY OF ATOMS HAS A POTENTIAL FOR GOOD.

MATERIALS

Cereal
Wire
Matches
Mousetraps
Toothpicks
Balsa wood
Alcohol
Metal pan or sheet of asbestos
Modeling clay
Watch or clock with illuminous dial

TEXTBOOKS

1 - 6 : 25-26; 132-133
2 - 6 : 353-359

ACTIVITIES

1. Have children bring in pictures of windmills and water wheels. It would be useful information to find out when they came into use and if they are still being used.

2. Pictures of steam engines, gasoline engines, and diesel engines can be found in current periodicals. Be conscious of the size of the various engines. Pictures of electric generators and motors can also be brought into the classroom. How are the various engines used?

3. Write-ups, articles and pictures of atomic explosions can be brought in and discussed. Again note the date of the articles.

4. As a culminating activity a time chart of sources of energy would prove quite interesting. This would show that most are very recent.

5. Pencils, chalk, water, ice cream, plants, animals, etc., are all made of atoms (elements). All matter is made of atoms. There are over 100 million atoms on the head of a pin.

6. As we begin dealing with atomic energy, we must be sure the students realize that this is based on the atomic theory. Atoms are too small to be seen with the most powerful microscope, but their structure and activities have been predicted by scientists. The fact that they have not been disproved for a long period of time permits us to put the term theory to it.

7. There are 92 natural elements (found in nature) and 10 man-made ones at present. The number of man-made elements may change. Elements are the building blocks of the universe. They are the main substances that cannot be composed of other substances; e.g., hydrogen (H), oxygen (O), mercury (Hg), iron (Fe), silver (Ag), etc. The letter or letters following the name denotes the symbol or shorthand method of designating the various elements.

8. Work on diagrams of atoms. From encyclopedias draw the hydrogen, oxygen and any other two atoms you can find. Compare the drawings. How are they alike? How different? Have the students familiarize themselves with the terms nucleus, protons, neutrons and electrons.

9. Have a student make a model of the hydrogen atom. Suggested materials may be cereal and toothpicks, clay and wire, or balso wood and wire. It is important to explain at this time that the space and size relationship must be forgotten as far as the models are concerned. Blough does an excellent job of trying to give a conception of the size and space between various atomic particles.

10. Students may now make models of atoms of other elements that contain neutrons as well as protons and electrons.

11. One of the advanced, interested students may want to make a model of a molecule. This is the result of combining atoms; e.g., the water molecule has two atoms of hydrogen and one of oxygen.

12. Have students read accounts of atomic bombings, Nagasaki and Hiroshima. Very little of the total amount of energy present in the atoms was used. Do not spend much time on destructive uses unless you are developing the vast quantity of energy contained in the atom concept.

13. When students look up fission in the encyclopedia they will be able to copy the chart as to what new atoms or elements are formed after the larger atom has been split.

14. An example of radioactivity is a watch or clock with a luminous dial. Look at the dial with a magnifying glass in a darkened room. It should be explained that rays are continually given off a radium source; the paint used on a luminous dial. It takes 1580 years for half the radium to disappear by changing to light flashes. This is called the half-life of radium.

15. Have the students look up material on the hydrogen bomb and compare energy released with that of the atomic bomb. It should be understood that the energy released comes from the changing of some of the matter to energy due to the high temperature. It takes 4 hydrogen atoms to make on atom of helium.

16. Sun spots and the eruptions on the surface of the sun are supposedly due to atomic fusion. This is true of the other stars as well.

17. Have students bring in pictures of the Nautilus (atomic submarine) and its atomic reactor. Basically the heat from atomic explosions changes water to steam which moves the blades of the ships' turbine which is connected to the propeller shaft. The reactor requires a heavy shield of lead to prevent leakage of dangerous radiations. The additional weight is the main reason its use, at present, is limited to larger engines. An atomic aircraft, surface ships and trains are now in the planning stages.

18. Elements whose atoms are easily split are called fissionable materials. One of the best is Uranium 235. When the nucleus splits, two or three neutrons speed off to split other atoms and so forth. This is called a chain reaction.
   Break 20 matches ¼ inch from the head end and lay them in a pattern from 1-2-4 etc. in a "Y" formation. The match heads represent U-235 atoms. Light one match and touch it to the first of the pattern. This represents a chain reaction. Matches should be on a metal tray or a piece of asbestos.

19. Take a measured quantity of water and the exact same amount of alcohol. Mix them together and note that they do not take up twice the space. This means that there is room between the particles that made up the substances for them to consolidate.

20. Use a number (15-20) of set mousetraps in a small area. Spring one and watch the results. This may give them an idea of a chain reaction. The same type idea may be arrived at by having the children form a human pyramid, 1 - 2 - 4 - 8 - 16 etc. Have the first person tap the next two and each one in turn tap two more. The arms could represent flying neutrons.

21. Radioactive atoms are used as tracers in living things; e.g., (a) The migration of mosquitoes from their home grounds was traced by breeding a batch in a pool containing radiophosphorus. (b) If radioactive iron compounds are injected into the blood stream of a human, the rate of formation and breakdown of red blood cells can be determined. Radioactive carbon dioxide gas is used as a tracer, in green plants, in the making of sugar. Radioactive phosphorus can be placed in various fertilizers to find out how easily each fertilizer gives up its phosphorus to plants, how they reacted to various kinds of soil, and how best to apply the fertilizer to the soil.

22. Give students an opportunity to write articles or make drawings of how they think peace-time use of atomic energy may change our lives in the future.

23. One use of radioactive atoms in industry is the control of the thickness of sheet materials. In the machines a radio active gun is placed on one side of the material to be tested and a detector on the other side. The thicker the material, the less radiation gets through. The detector is hooked to a control that changes the mechanism that controls the thickness of the material produced.

24. The children should be encouraged to bring or keep a scrap book on atomic energy. This will help them realize how much is being done in the field at the present time.

25. Students may want to look up and report on some of the men influential in the atomic energy field e.g. Einstein, Fermi. etc.

GRADE 6

TERMINOLOGY

Atom - Is composed of a nucleus containing protons and neutrons (with the exception of hydrogen) around which revolve electrons at very high speeds.
Atomic Number - The number of protons in the nucleus of an element.
Atomic Energy - The use of the atom to do work.
Atomic Weight - The weight of the atom which is usually equal to the sum of the neutrons and protons.
Chain Reaction - The splitting of an atom with a free neutron which causes the atom to give off free neutrons to split other atoms. This continues until all the concentrated atoms are split.
Control Rods - Cadmium or boron rods used to absorb some neutrons during controlled chain reaction.
Cyclotron - A scientific instrument for splitting atoms under controlled conditions.
Electron - A negatively charged body found outside the nucleus of an atom.
Element - A basic substance that cannot be composed of other substances.
Geiger Counter - A small metal tube for detecting atomic particles.
Fission - The process of splitting an atom.
Fusion - The putting together of atoms of lighter elements under terrific heat.
Half Life - A set rate of speed at which radioactive materials disintegrate.
Heat Exchanger - A boiler where heat from an atomic pile is changed into steam.
Ion - An atom, molecule, or atomic particle which has an electrified charge.
Isotope - An atom of any single element that differs only in the number of neutrons.
Molecule - The combination of two or more elements to form a small particle of a substance.
Neutron - A neutral body found in the nucleus of all atoms except hydrogen.
Nuclear Energy - The energy released when a nucleus of an atom is split.
Nuclear Fission - The process of splitting the nucleus of an atom.
Nucleus - The center of the atom which is composed of protons and neutrons.
Proton - A positively charged body found in the nucleus of an atom.
Radioactive - Atoms that give off part of themselves in the form of rays, then change to other substances.
Uranium - A metal element, one of the heaviest in the world, which gives off a mild radiation.

RESOURCES

1. Franklin Institute, 20 and Parkway, Phila., Pa. Contact Mr. Neathery, Director, LO 4-3600. Film "A is for Atom" can be shown. Nuclear Reactor demonstration. Special programs for school groups.

2. Atomic Energy Commission, Eductional Service Branch, Washington 25, D.C. (for teaching materials).

3. Westinghouse Electric Corporation, School Service, 401 Liberty Ave., P. O. Box 2278, Pittsburg 30, Pa. (for catalogues of teaching materials on atoms and atomic energy).

RESOURCE PEOPLE

1. Mr. Baldwin, Teacher Ardmore Junior High School, for demonstration on Civil Defense procedures in radioactivity.

FILMS

Atomic Energy	Radnor Film Library
Atom Goes to Sea	" " "
A Tale of Two Cities	Dept. United World Films, 1445 Park Ave. New York 29, N. Y.
Operation Crossroads	" " " " " " " (both are Gov't. films)

FILMSTRIPS

Atoms and Molecules	(SVE)

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Grade 6

ELECTRICITY

The study of electricity should help both girls and boys to realize the continous presence and ever-growing importance of this force in daily living. The children's need of knowledge to cope with this expanding power should stimulate their attitude toward its study.

The pupils should recognize both frictional and current electricity as component parts of their lives. The uses man has found for this energy, the safety regulations he has established for its employment, control this giant to make it our servant rather than our master.

CONCEPTS

Objects made of iron and some other metals are attracted by magnets.(1)
Magnets are strongest at their poles.(2-3)
Like poles of magnets repel, unlike poles attract each other.(4-5)
The earth acts like a magnet.(6-7)
The magnetism of a substance is due essentially to the magnetic qualities contained in and the arrangement of the atoms. (8-9-10-11)

MAGNETISM AND ITS PROPERTIES ARE FOUND IN ONLY A FEW METALS.

The contact and separation of two surfaces may permit electrons to be torn away from one and deposited on the other. Both acquire a charge of frictional or static electricity.(12)
The object that loses electrons acquires a positive charge; the one that gains electrons, a negative charge.(13-15)
Like charges repel, unlike charges attract.(13-14)
Light ning results from a flow or jump of electricity through the air to another object. (16)

STATIC*ELECTRICITY KEEPS EXTRA ELECTRONS ON OBJECTS UNTIL THEY ARE FORCED TO JUMP.

Current electricity is the flow of electrons in a circuit. (17-18-19-20-21-22-23)
In dry cells and batteries, chemical action starts electrons moving in one direction to make a current. (24-25-26-27)
Moving a coil of wire near a magnet or a magnet near a coil of wire causes electrons to flow in the coil. This is changing motion into electricity, the principle of the generator or dynamo. (28)

THE FLOW OF ELECTRONS THROUGH A CONDUCTOR MAY START IN DIFFERENT WAYS.

Electrical energy can be converted into heat, light, motion, and sound.(22-29-30-31-33-34-37)
Electrical energy is measured in kilowatt hours. (35)
Electrical energy is necessary in the operation of the electromagnet. (32)
The electromagnet is fundamental in the working of the electric motor, telephone, telegraph, etc. (33-34)

ELECTRICAL ENERGY CAN BE MEASURED AND USED FOR MANY PURPOSES.

Safety rules for using electrical appliances (38-43)
Safety rules for using electric wires (39-43)
Safety rules for using fuses (40-43)
Safety rules for using switches (41-43)
Safety rules for using electric heaters (42-43)

RESPECT ELECTRICITY AT ALL TIMES

MATERIALS

- Bar magnets
- Glass square
- Lodestone
- Hot plate
- Wool cloth
- Rubber rod
- 2 dry cells
- Steel wool
- 1 lemon
- Horseshoe magnet
- Steel needles
- Glass jar
- Hammer
- Glass rod
- Ping-pong balls (2)
- Copper wire
- Copper strip
- Iron nail
- Iron filings
- Compass
- Pliers
- Balloon
- Silk cloth
- Thread
- Doorbell or flash light bulbs
- Zinc strip
- Nichrome wire

TEXTBOOKS

1-4 : 164-183
1-5 : 202-225
1-6 : 197-211
2-4 : 249-257
2-5 : 266-308
3-4 : 139-155
3-5 : 64-66
3-6 : 121-155

ACTIVITIES

1. As a motivating activity have a bar and horseshoe magnet suspended from a stand and have paper clips, tacks, etc., hanging from them. Also have a piece of wood about the same size as the bar magnet with nothing clinging to it. Have a variety of materials on the table to see which ones are attracted to the magnets. This is a recall-type activity that was done in the third grade.

2. Place a bar magnet on a flat surface. Place a sheet of window glass or stiff cardboard on top of the magnet. Sprinkle iron filings over the glass or cardboard. Each iron filing acts like a tiny magnet and lines up with the poles of the magnet just as a compass will. So the iron fillings map out the magnetic field and show the lines of force. Note that the lines of force are concentrated at the poles and are weakest near the middle of the magnet.

3. Repeat the second activity with a horseshoe magnet. Again notice how the magnetic field is concentrated at the poles.

4. Repeat the second activity with the north poles of two bar magnets placed about two inches away from each other. Notice how the like poles seem to push against each other's lines of force.

5. Repeat the fourth activity with the north pole of one bar magnet near the south pole of another bar magnet. Notice how the lines of force seem to attract each other.

6. Stroke one end of a steel needle slowly from the middle to the end against one pole of a permanent magnet. Repeat this five or six strokes. Now hold the needle by the other end and stroke it slowly over the other pole of the permanent magnet. Suspend the magnetized needle by a thread. Why does it align itself in a north-south position?

7. Lodestones, which means "leading stones",have been known since ancient times. Lodestone is an iron ore that possesses magnetic properties. Lodestones can be used in all activities in which artificial magnets are used. Artificial magnets are made of nickel and cobalt as well as iron. Some alloys such as iron and steel make powerful magnets. One such alloy, called "alnico", is a combination of alumunum, nickel, cobalt, manganese, silicon, and iron. Alnico magnets will lift over fifty times their own weight.

8. Magnetize a steel needle as previously described (6). Now break the needle in half. Use a cutting pliers if necessary. Test the polarity of each piece. Actually you could break the needles into many small pieces and each piece would still have a north and south pole.

9. Fill a test tube or a narrow, small jar with iron fil ings. Holding the jar horizonally, carefully stroke it against a strong bar magnet 5 or 6 times. Bring the jar near a small compass. You will find that the jar of filings acts like a bar magnet. Each filing has lined up with its north pole pointing in the same direction as that of the other filings. Now shake the jar violently and test with the compass. The shaking has mixed up the filings so that the jar no longer acts as a magnet. The filings are analogous to molecules in iron.

10. Magnetize two steel needles. Grasp one with a pliers and hold it in a flame or over an electric hot plate for about three minutes. It will now attract less iron or steel than it did previously although the unheated needle has lost practically none of its force.

11. Magnetize both needles again. This time strike one with a hammer repeatedly. Compare its magnetic force before and after you hammer it. Striking the magnet makes it weaker. Heating and striking a magnet cause the molecules to become rearranged or disarranged. For this reason magnets are best stored in a cool place where they cannot easily be dropped.

12. Blow up a balloon and rub it vigorously on a piece of wool. If no wool is available, rub it against your hair. Try to place the balloon on the wall. You will see that the balloon now has a static electricity charge and is attracted to the wall. It will remain on the wall until the charge leaks off.

13. Rub a glass rod with silk and suspend it from a string. Now rub the hard rubber rod with wool and bring it near the suspended glass rod. The two rods will attract each other. The rubber rod acquires a negative charge and the glass rod a positive charge in this activity. Negatively charged electrons move from the wool to the rubber rod, thus charging it negatively. Electrons move away from the glass rod onto the silk, thus leaving the glass rod positively charged.

14. Suspend two ping-pong balls from the silk thread about one half inch apart. A drop of glue will hold the thread to the ping-pong ball. Be sure there is no wind. Now rub the comb or fountain pen against a piece of wool. Touch it to one ping-pong ball, then the other. The ping-pong balls will swing away from each other since each one has been simitarly charged.

15. Rub a glass rod vigorously with a piece of silk and suspend it from a string. You know the glass rod is positively charged from previous activities. Bring the object you want to test near the glass rod. If it attracts the glass rod, the unknown object is negative. If the glass rod is repelled the object with the unknown charge is positive.

16. If the above frictional activities are done in a darkened room, you should be able to see flashes when electrons move from one object to another. This actually is electricity, the flow of electrons from one object to another.

17. Connect a dry cell, flashlight bulb (or door bell), and the insulated copper wire. Repeat, using string or paper for copper wire. This shows that the circuit or path of electrons must follow a conductor such as copper. Most metals are good conductors. The best are silver, copper, aluminum, steel and certain alloys in that order. Copper is generally used because it is an excellent conductor and relatively cheap.

18. In Activity 17 the bell or bulb may be turned off without disconnecting the dry cell by cutting the wire of the circuit. If this is done, scrape the insulation off the cut ends and fasten the ends to the two binding screws of a switch or push button. A switch is simply a device to close and open a circuit. There are many types of switches.

19. A series circuit is one in which the electrons flow through every conductor or element in the circuit. Connect 2 bulbs or bells to a dry cell so that the current goes through one bulb, on to the next and then back to the dry cell. This is the way some Christmas tree lamps are connected. When one bulb burns out, all the bulbs go out. The more bulbs you connect in series circuits, the dimmer each bulb becomes. One of the students may have a string of series Christmas tree lights. See 1-5: 222-223

20. A parallel circuit is one in which each bulb, or other element, is connected to the same conducting wire. In other words there are always two or more paths for the current to flow through. Connect two bulbs or bells connecting all positive poles with one wire, all negative poles with another and then connect these to the dry cell. When a bulb burns out or is unscrewed in a parallel circuit it does not break the circuit. The other bulb continues to burn. Houses and other buildings are wired with parallel circuits. Most students have Christmas tree lights that are wired as parallel circuits.

21. A transformer is a device used to change the voltage of a current. A step up transformer increases the voltage; this is done to send electricity great distances. A step-down transformer reduces the voltage; a doorbell transformer will cut 110 volts to about 6 volts. (Voltage refers to the pressure of a current). Using a toy transformer, connect a bell and move the handle; note the difference in loudness of bell. Transformers can be pointed out in the community. They are the large block boxes on some telegraph poles. Our house voltage is 110-115.

22. Any given circuit has a limit to the amount of current which may safely pass through it. A fuse is a safety device that will melt and break the circuit if too much current is being carried. The fuse has a low melting point material. Connect two dry cells in series (positive to negative). Now connect the cells with a short piece of bare copper wire for a few seconds. It gets quite warm. Repeat with thin, bare copper wire. It may get hot enough to glow. Now connect a short piece of steel wool; it quickly melts and opens the circuit. It is a fuse. Fuses are rated 15 amps, 20 amps, etc., to show how much current they will permit in a circuit. The lowest number that will permit the circuit to function is the safest fuse.

23. An electric-current detector (Galvanometer or Galvanscope) can be made by following directions from Experiment 1 in the pamphlet "Electricity". Thumb tacks can be used in place of the Fahnistock clip.

24. Wrap the bared scraped ends of a copper wire around a piece of clean copper. Do the same with another piece of wire and a piece of clean zinc. Connect the other bared end of the copper wire to a galvanometer or current detector. (Activity 23). A slight deflection of the needle shows that a slight current is flowing. Your saliva and the two dissimiliar metals have made an electric cell.

25. Repeat Activity 24 putting the 2 strips of metal in 2 gashes in a lemon. Again observe the current detector, the needle deflection again indicated electric current flowing. There are different types of chemical cells but they all use the dissimilar metals or carbon in a solution or paste.

26. The dry cell is a chemical cell using a carbon rod and a zinc container for the metals and a paste material in place of a liquid. The electrons travel in one direction so we say the current is direct current (DC). The dry cell could be more correctly termed a moist cell but it is dry when compared with the voltic or wet cell. Have an old one cut in half to examine.

27. A battery is two or more cells connected in series to produce a greater current. Storage batteries have found an important use in automobiles. Modern cars require a 12-volt battery, while 4 or 5 years ago a 6-volt battery was common..Storage batteries are often installed in hospitals and other institutions as an auxiliary source of electricity, ready to supplant the regular supply in an emergency. Two or more dry cells can be connected in series to show how the voltage is increased. (connect positive of one to negative of the next- thus adding the voltages). This can be checked on the current detector.

28. Wrap 100 turns of insulated copper wire around a large nail. Be sure that you wrap only in one direction. Leave about two feet of wire sticking out at each end. Fasten the bared, scraped ends of the wire to the terminals of a galvonometer(current detector). Now bring the north pole of a magnet near the nail and move the magnet rapidly from one end of the nail to the other. The galvonometer needle deflects, showing that a current has been inducted. Move the magnet the other way, and the needle deflects in the opposite direction. This is the principle of the generator or dynamo. The current changes or alternates direction, so we call the current produced alternating current (AC). This is the type used in our homes.

29. Repeat Activity 22 using a nichrome wire if available. Length for length and diameter for diameter it will heat much more quickly and to a higher degree than the copper wire. The thinner or shorter the wire, the more heat will be generated. These are used in toasters, hot water heaters, etc. Have a small portable electric heater brought into class. Observe how quickly it heats.

30. A flow of electricity is always accompanied by heat. If a conductor becomes hot enough, it begins to glow. Incandescent bulbs have filaments of tungsten which can get extremely hot without melting. Such bulbs are filled with nitrogen so the hot wire does not oxidize. Repeat the copper wire part of Activity 22 with the room darkened.

31. Place a burned out, incandescent bulb in a pail full of water. Hold the bulb by the screw base. Tap the glass with a hammer. Now remove the bulb and examine the filament. Note how it is suspended on a glass rod. The ends of the filament go down into the socket. One end is soldered to the side and the other to the middle of the socket. The screw socket is insulated from the other contact point in the middle.

32. Wind insulated wire around an iron nail about 15 times; connect the wire to a dry cell. Notice how this device picks up paper clips, etc. This is an electromagnet. Disconnect the terminals and wind 15 more turns around the same electromagnet. Connect the ends of the wire to the dry cell and notice how many paper clips or tacks are attracted.

Increasing the number of turns around the electromagnet makes the electromagnet stronger. Increasing the amount of current flow in an electromagnet makes it stronger. Electromagnets are temporary magnets functioning only when electrical current is passing through.

33. There are many ways to construct electric motors. Experiment 5 in the pamphlet, "Electricity," is one way. All motors change electricity into motion. If you can secure a toy electric motor connect it to some dry cells and make it run. Try to have students pick out the parts of a motor: (field magnets, brushes, armature, and commutator). Electric motors are used in vacuum cleaners, refrigerators, oil burners, electric razors, mixers, electric clocks, etc.

34. In the telegraph, a spurt of electricity causes an electromagnet to attract an iron bar and make a click. In the telephone, a spurt of electricity causes an electromagnet to attract an iron disk, which then emits speech. Experiment #2 in the "Electricity" pamphlet explains how a telephone transmitter can be made. Some of the boys and girls may have telegraph keys they can bring to class and explain.

35. In electricity we say an ampere is a measure of the rate of flow of electrons through a wire. A volt is a unit of electric push (pressure needed to keep electrons going at a certain rate). An ohm is a unit of electrical resistance. The watt (amperes and volts) is a measure of electric power. The kilowatt hour is the unit that measures the amount of electrical power. A 100 watt lamp used for 10 hours, the work done is 1000 watt hours or 1 kilowatt hour. Our electric meters measure the electricity we use in kilowatt hours. Try to have students look at electric bills to see if they can figure the approximate rate. The electric company would cooperate in furnishing the information.

36. Have students make a list of electrical appliances.

37. Some of the more interested and advanced students may want to attempt making a crystal radio set. Refer them to Experiment 6 in "Electricity" pamphlet.

38. Electrical appliances:
    1. Disconnect all electrical appliances when they are not being used.
    2. If there is a switch on an electrical appliance, turn it off before you disconnect the appliance. Also be sure that the switch is turned off before you connect the appliance.
    3. Never use an electrical appliance or an electric cord that you know is our of order.
    4. Never try an experiment with an electrical appliance or an electric cord that is connected to the current in your home.
    5. Never touch an electrical appliance with wet hands. Also be sure not to touch it if any part of your body is touching a water pipe.

39. Electric Wires:
    1. Never touch electric wires or use an electric cord on which the covering is worn.
    2. Keep electric wires and cord from rubbing against things or becoming linked.
    3. Stay away from broken wires that hang down from poles or buildings.
    4. Never climb a pole that supports electric wires.

5. Never touch an electric wire or cord with wet hands. Also, do not take hold of a wire or cord while any part of your body is touching a water pipe, faucet, or radiator.

40. Fuses- circuit breakers:
    1. Never try to repair a "burned out" fuse. Use a new one.
    2. Where a fuse "burns out", always put in a new fuse that will carry the same amount of current. Replace a 15 Amp. with a 15 Amp. fuse.
    3. Never try to use a penny instead of a new fuse. The penny is made of copper, it will not melt until the copper wires do.
    4. Always turn off the current when you put in a fuse. Otherwise you may get a shock.
    5. Never stand on a damp floor in a basement when you put in a new fuse. Stand on a dry board.

41. Switches:
    1. Have a switch repaired at once if you get a shock when you use it to turn current on or off.
    2. Never touch a switch with wet hands. Also, do not touch a switch when any part of your body is touching a water pipe, faucet, or radiator.

42. Electric heaters:
    1. Never use a knife, fork, or spoon to get bread out of an electric toaster, while it is turned on. You may get a shock or a burn; or you may cause a short circuit.
    2. Do not use a damp cloth to clean the outside of an electric heater while it is turned on. Disconnect the heater and wait until it cools.
    3. Do not go away and leave an electric iron connected. It may set the ironing board on fire.
    4. Do not hang wet clothes on an electric heater to dry. You may cause a short circuit or a fire.
    5. Never touch an electric heater while you are in a bath tub or while any part of your body is touching a water pipe, a faucet, or a radiator.
    6. If you use an electric heating pad, be sure that it has a waterproof cover. You may get a shock if perspiration soaks into it.

43. After discussion on the "whys and wherefores" of the above safety measures it is quite important that the children pass this information on to their parents. They should be cautioned against telling the information as compared with discussing it. The children should be interested enough in their homes to want to know where their fuse box is.

44. An interesting culminating activity might be to have the children plan a "week without electricity". What they could substitute for certain appliances, how they use electricity, etc. This could be carried further; what the community would do if it did not have electricity.

Grade 6

RESOURCES

1. Philadelphia Electric Company, Ardmore.
2. W.C.A.U. - City Line and Monument Aves., Phila. Call: GR 7-8300 Contact Miss Mary Kearney, Ed. Director. Guide provided for tour. Two weeks advance notice advisable.
3. R C A Victor Division, Camden, New Jersey. Call: Woodlawn 3-8000, Ext. 2337. Contact: Emily Dodelin, Manager. Subject area: Electricity and Magnetism. Guide provided for tour.
4. Bell Telephone Company of Pennsylvania.
5. General Electric Company, Public Relations Dept., 2-119 Schenectady 5, N.Y. Publications: "Edison and Electricity," "Motors Make the World Go Round," "The Romance of Electricity."

RESOURCE PEOPLE

1. School Custodian   2. Amateur radio operator
    3. Electrical engineer

FILMS

Electromagnets - Radnor Film Library
Flow of Electricity " " "
Making Electricity " " "
Magnetism " " "
Principles of Electricity " "

FILMSTRIPS

Electricity - SVE
Electric Magnet "

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Rockcastle, Verne N., *Electricity and Magnetism*. Cornell Rural School leaflet Vol. 50, No. 3, 1957
Unesco Source book for Science Teaching
Any good general science textbook

Children: Beeler, Nelson F. and Branley, Franklyn M. *Experiments with Electricity*. Crowell, 1949
Epstein, Sam & Beryl, *The First Book of Electricity*. Scribner's, 1951
Huey, Edward G., *What Makes the Wheels Go Round*. Reynal & Hitchock, 1940
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Schneider, Herman & Nina, *Everyday Machines and How They Work*. McGraw Hill, 1950
Weir, Ruth C., *Thomas Alva Edison, Inventor*. Abington-Cokesberry Press, 1953
Yates, Raymond F., *Boy and a Battery*, Harper, 1942
Yates, Raymond F., *Boys Book of Magnetism*, Harper, 1941
Zinn, Herbert S., *Lightning and Thunder*. William Morrow, 1952

LOWER MERION SCHOOL DISTRICT GRADE 6

THE UNIVERSE

This unit is intended to introduce children to the immensity and complexity of our universe. Concepts are presented which stagger the imagination, but are included in order to show that the more man learns, the more questions arise. Material about trips into space, light, "nuclear furnaces," constellations, and instruments is offered in an attempt to bring the otherwise intangible study of the universe into a child's scope and interest. Our main objective is to open the study of our universe to our children.

CONCEPTS

Early man thought earth was the center of the universe. (1)
The great astronomers and thinkers have added to man's knowledge of the universe. (2*)
MAN'S IDEA OF THE UNIVERSE HAS CHANGED OVER THE CENTURIES.

Our sun, its nine planets and their natural satellites, are known as the solar system. (3)
Our sun is an average sized star in the Milky Way galaxy. (4)
A galaxy is a large cluster of billions of stars. (5*)
The Milky Way galaxy is a flattened disc-shaped galaxy. (6)
Our sun is located near the outer edge of our galaxy. (6-19)
Our sun is but one star among one hundred billion others which make up the Milky Way galaxy. (5)
Our galaxy is one of a local group of perhaps sixteen galaxies (sometimes called a supergalaxy). (5-18)
There are at least a billion galaxies that can be photographed with the biggest telescopes; there may be countless more beyond the range of man's ken. (5)
THE UNIVERSE IS IMMENSE. OUR SOLAR SYSTEM IS BUT A MINUTE PART OF THE MILKY WAY GALAXY.

The stars in the Milky Way galaxy are revolving around the center of the galaxy. (7*)
Our sun makes a revolution around the center of our galaxy in about two hundred million years. (8)
The galaxies are moving away from one another in space at terrific speeds. (9-51)
OUR UNIVERSE IS IN MOTION AND IS EXPANDING.

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*These numbers refer to items under Activities and Data that provide facts for the teaching of the concept. Teacher judgment as to the appropriateness of some items for a class should determine whether they should be used.

The measurement in miles used on earth is inadequate for space beyond the solar system. (10-11-12)
Scientists have learned to measure the speed of light. (13*-14)
A light year is the distance that light travels in a year. (15)
Astronomers use the measurement of the light year for distances in space. (16-17-18-19)
LIGHT YEARS ARE THE ASTRONOMERS' UNIT OF MEASURE FOR THE UNIVERSE.

The stars are divided into classes, or magnitudes, of apparent brightness. (20)
Star brightness is due partly to its distance from the earth. (21-22-23)
Star brightness is due partly to the size of the star. (21-22)
Star brightness is due partly to its temperature. (24-25)
THE APPARENT BRIGHTNESS OF A STAR MAY BE DUE TO VARIOUS FACTORS.

People long ago traced pictures of familiar objects, animals, and human beings in the pattern of stars. (26-28-29-30)
Knowing the constellations serves as a guide for locating heavenly bodies. (27-31)
The only thing stars in a constellation have in common is that they lie in the same direction from the earth. (21-22-32)
CONSTELLATIONS ARE SKY PATTERNS OF STARS THAT HAPPEN TO LIE IN THE SAME DIRECTION FROM THE EARTH.

The sun and other stars are giant nuclear furnaces. (33*)
The nuclear process that occurs on the stars is called fusion. (33*-34*)
MAN IS ATTEMPTING TO CREATE THIS TYPE OF NUCLEAR POWER ON THE EARTH FOR PEACEFUL PURPOSES.

The sun and other stars send out energy in many forms. (35)
Light is but one form of the stars' energy. (35)
The entire range of this energy is called the electromagnetic spectrum. (35-37)
The visible part of the spectrum--the part of the stars' radiation or energy that we can see, we call light. (36-38-39-43)
Ninety-five per cent of the energy from the sun is light; the other five per cent is invisible. (40)
Ultraviolet and infrared are two kinds of invisible radiation. (40*-41*-42*)
LIGHT IS BUT A SMALL PART OF THE RANGE OF ENERGY CALLED THE ELECTROMAGNETIC SPECTRUM. (Chart of electromagnetic spectrum is shown in activities.)

Radio waves, light, and heat bring us news from space. (37-49)
Telescopes that "see" by means of light waves are called optical telescopes. (44)
Optical telescopes are of two types: refracting and reflecting. (44-52)
Radio telescopes make use of radio waves to "listen in" to sounds from outer space; the radio waves are caused by violent atomic activity. (37-45-49-53)
Radio telescopes should be able to see nineteen times farther into space than optical telescopes. (46-47-48*)
A spectroscope breaks light into its component colors. (50*)
INSTRUMENTS HAVE BEEN DEVISED BY MAN TO EXPLORE THE UNIVERSE.

Larger, more sensitive telescopes, spectroscopes, and radio telescopes have been built recently. (46-48-50*-54)
More sensitive film is being developed continually. (41-55)
New discoveries about the universe are constantly being added to our present store of knowledge. (48-56-57*)
EACH YEAR OUR KNOWLEDGE OF THE UNIVERSE INCREASES.

MATERIALS

15 watt bulb
40 watt bulb
Dime
Silver dollar
Aluminum foil
Nail
Pliers
Umbrella
Shoe box
Flashlight
Can
Prism
Diffraction grating replica
Ultraviolet lamp
Fluorescent materials
Telescope
Radio
Centrifugal tops

TEXTBOOKS

1 - 5 : 88-95
1 - 6 : 98-117
2 - 5 : 6,7
2 - 6 : 234-277
3 - 6 : 187-214

ACTIVITIES AND DATA

1. It is easy to see how early man could think the earth was the center of the universe. This is what they could "see" happening; today we know from scientific proofs that all these apparent movements occur because the earth spins once a day upon its axis. What is actually happening is often not the same as what appears to happen.
   In ancient times, men thought the stars were placed on a great, glassy globe (the celestial sphere) and that the earth was inside the globe. Ancient man thought that the sun, moon, and planets were between the glassy globe and the earth and that these bodies spun around the earth once a day.
   Pretend that you are an ancient man and scanning the heavens. What things in the heavens would apparently "prove" that the earth is standing still? Why were the planets given the name which means "wanderers" in Greek? The stars and constellations appear to slowly change their positions while the earth seems to remain stationary. The planets wander much more rapidly through the "fixed" stars.

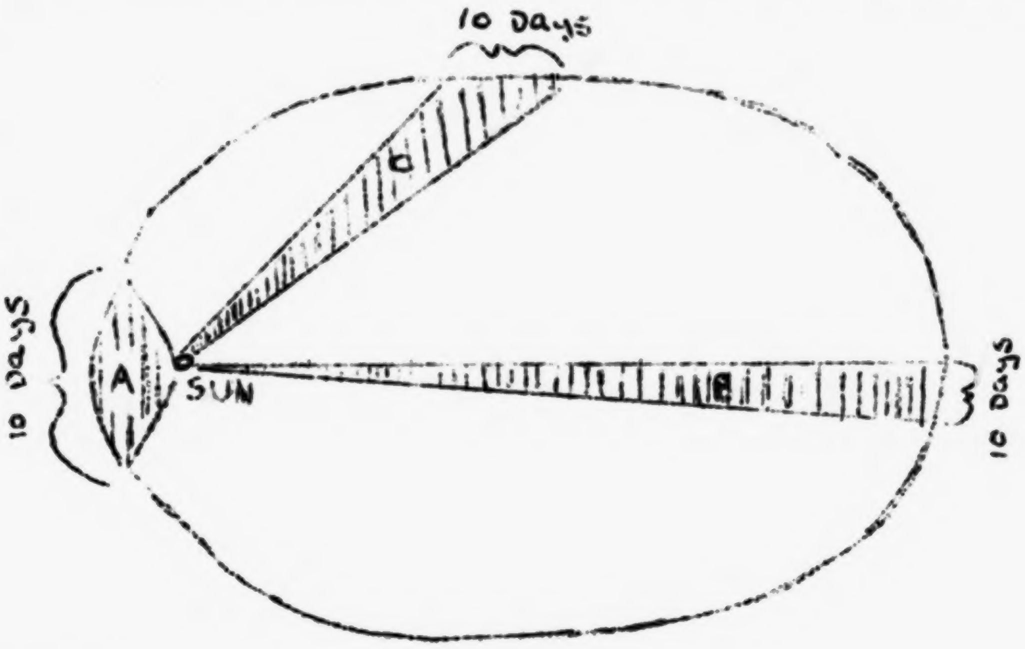
2. How the great astronomers and thinkers have added to our knowledge of the universe:
   Ptolemy of Alexandria (A.D. 130) nearly two thousand years ago knew that the earth was spherical, but he believed it to be the center of the universe with the sun, moon, and planets circling it. (Aristarchus, a Greek, held that the earth revolves around the sun but friends urged him to keep quiet lest he endanger his life.)
   Nicolaus Copernicus (1473-1543), a Polish churchman, believed the sun, not the earth, to be the center of the universe; the earth was but one of the planets circling the sun. The stars were great fiery globes so far away that we could not imagine their great distances. Copernicus is called the "father of astronomy."

Here is a good place to introduce the children to the words geocentric (earth-centered) and heliocentric (sun-centered).

Galileo Galilei (1564-1642) was the first astronomer to use a telescope to probe the heavens. He learned that Venus had phases like our moon; here was proof that Venus circled the sun. He showed that the Milky Way was made up of innumerable stars. Galileo, called the "father of physics," understood that natural forces control the movements of bodies in space. Galileo is generally credited with discovering four of the moons of Jupiter. To Galileo, Jupiter was a miniature model of the solar system.

Johannes Kepler (1571-1630) advanced reasons for believing the moon caused the tides and worked out the three laws of planetary motion which demolished the Ptolemaic theory of the earth as the center of the universe. He confirmed Copernicus' belief that the earth revolved about the sun and ushered in the era of modern astronomy.

(For the very able) Kepler's three laws of planetary motion: (1) the planets travel in elliptical orbits about the sun. (2) A line drawn from a planet to the sun sweeps over equal areas in equal times.



The shaded areas swept
over in ten days are all equal.

(3) The squares of the periods of revolution are proportional to the cubes of the mean distances from the sun. The yardstick in our solar system is the distance from the earth to the sun, 93 million miles, and is called the astronomical unit. Mars, for example, revolves around the sun in 1.88 years at a mean distance of 1.52 astronomical units.

The square of the period is 1.88 x 1.88 or 3.53. The cube of the distance is 1.52 x 1.52 or 3.51. The two are nearly equal and the same relationship holds for the other planets, too.

Sir Isaac Newton (1642-1727) discovered the law of gravity - that every object, every particle in the universe attracts every other object. (Einstein's theory of General Relativity modifies this when matter approaches the speed of light. For most purposes, however, the law is still valid.) Newton discovered three laws of motion: the third law is what makes space flight possible: to every action, there is an equal and opposite reaction. He studied the rainbow effect made by light shining through a prism; learned that white light is made up of different colors. Newton showed that the three laws of Kepler are merely different aspects of the law of gravitation and can be derived from it. Newton is credited with inventing the reflecting telescope.

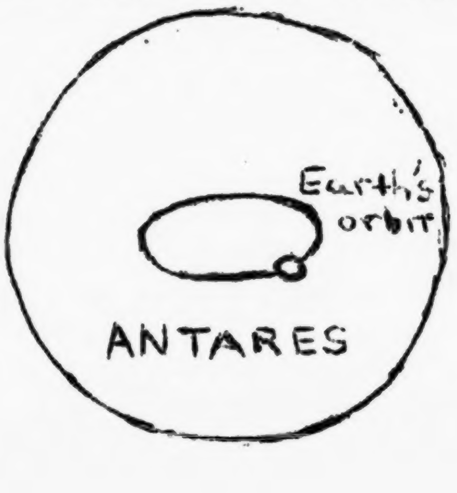
Sir William Herschel (1738-1822) was the astronomer who made one of the first maps of the Milky Way galaxy. He theorized that the galaxy stars formed a shallow disc with the sun somewhat to one side and close to the galactic center.

(For the very able) Albert Einstein (1879-1955) was a theoretical physicist who helped change man's concept of the physical world and reality in the universe. Einstein published studies which showed that in certain circumstances, mass and energy can be changed into each other. When a mass (m) is changed into energy (E), the amount of energy released is stated by $E=mc^2$. C is the constant speed of light in a vacuum and light is the only constant in the universe. Einstein changed our thinking of time and space; according to Einstein, the closer the speed of some body gets to the speed of light, the length of the object shortens and the weight increases. Einstein showed mathematically that the faster a body moves in space, the slower time moves in the body. For instance, were it possible for a rocket to travel at 163,000 miles per second, a clock aboard the space ship will tick one second for every two seconds of a similar clock on the earth. If an astronaut left a twin brother behind on earth and travelled in space at 163,000 miles per second, he would age at a rate exactly half that of his brother left behind. Many of Einstein's predictions have been proved by observation.

Do some research on some of the other great astronomers and thinkers, such as: Aristarchus, Tycho Brahe, Edmund Halley, Caroline Herschel, Percival Lowell, Maria Mitchell, Claus Roemer, Etc. Make short reports to the class.

3. Do a quick review of the solar system. See the fourth grade unit on the solar system. We must bring in the planetoids (preferable to the asteroids, which means little stars), comets, and meteors that also move about the sun and are a part of our solar system.

4. The average size of the sun can be shown graphically by comparing it with Antares, a red giant star in the constellation Scorpion. Antares' width is about four hundred million miles; this is about twice the width of the orbit the earth follows around the sun. If Antares were placed where our sun is, the earth would be inside the star, halfway between the center and the surface. Sixty-four thousand suns could be put into Antares to equal its mass. A plane flying at 1,000 miles per hour would take 160,000 years to cross from one end of Antares to the other.

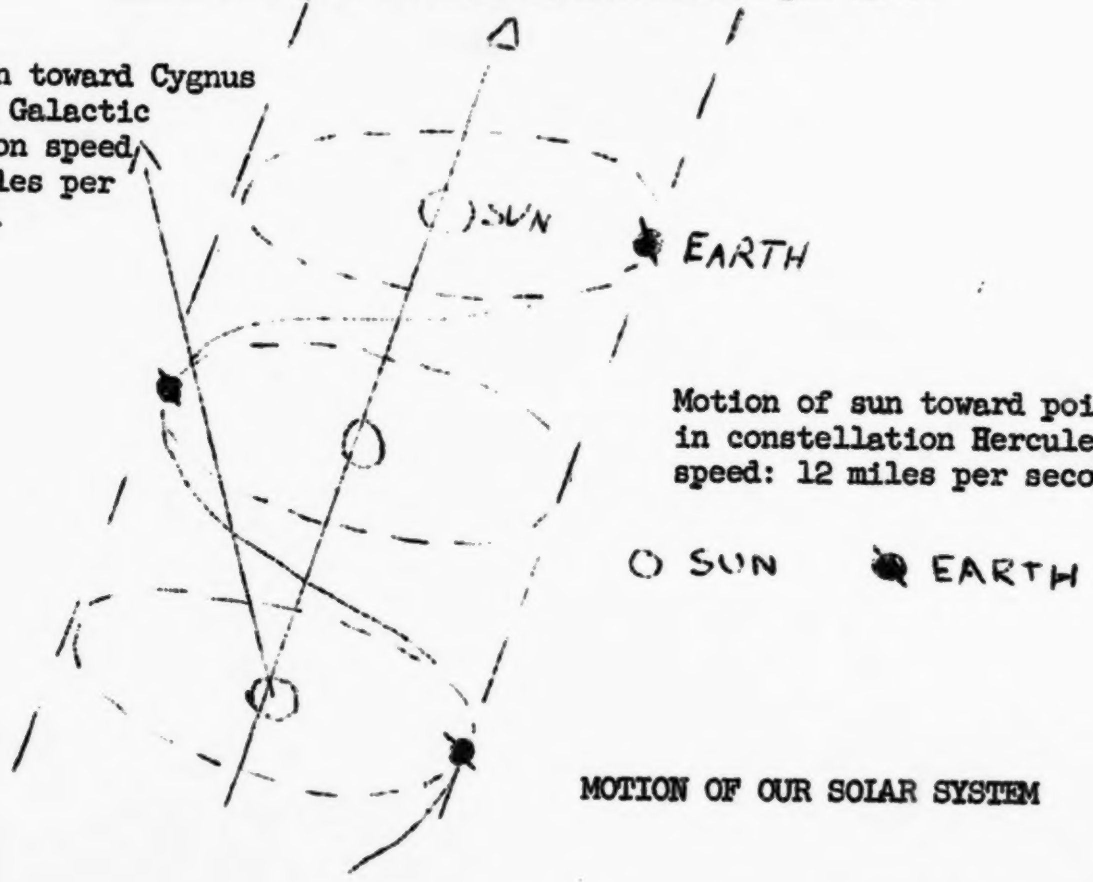


5.* Stars are found by astronomers in big groups or galaxies, separated by wide spaces. Our galaxy contains more than one hundred billion stars. Our galaxy is one of a local group of perhaps sixteen galaxies. Astronomers estimate that there are at least a billion galaxies that can be photographed with the biggest reflecting telescope, the 200 inch at Mr. Palomar, California.

6. Astronomers say that the Milky Way galaxy is a flattened disc shaped galaxy with a central bulge; this is the way it would appear to us if we could observe it edgewise from a vantage point on another galaxy in space. It would look like a spiral galaxy if we could look at it from above or below it in space. The angle of viewing the galaxy determines how it would appear to us in space. The position of our solar system is in the outer edge of a spiral arm.
Have the children look up pictures in reference books (see, for example, Schneider, Science for Today and Tomorrow, Grade 6, pp. 274-275) and draw pictures of what our galaxy would look like seen from different vantage points. Have the children draw these.

7.* The Milky Way is forever spinning like a giant pinwheel; some astronomers have thought that this pinwheel motion is what has caused our galaxy to flatten out in the shape of a disc.
Here is a riddle for the children: how can they be moving at several thousand miles an hour while they are sitting still at their desks? An astronomer would have us remember these simultaneous motions in space:

(1) the speed of the earth as it spins like a top (rotation);
(2) plus the earth's speed as it circles the sun (revolution);
(3) plus the sun's speed as it moves toward constellation Hercules
(4) plus the sun's speed as it moves toward Cygnus due to rotation around center of galaxy
(5) plus the speed of our galaxy as it moves through space. This all adds up to several thousand miles per hour.



Motion toward Cygnus due to Galactic rotation speed, 170 miles per second.

Motion of sun toward point in constellation Hercules - speed: 12 miles per second.

MOTION OF OUR SOLAR SYSTEM

8. Since the sun revolves about the center of the Milky Way galaxy once in 220,000,000 years, how many times does it rotate in a billion years? (five times that) If our sun is from four to five billion years old, how many trips has it made around the center of our galaxy?
(If the sun is four billion years old, it has revolved around the galactic center twenty times. If the sun is five billion years old, it has revolved twenty-five times around the galactic center.)

9. An approximate picture of this can be shown by pasting disc-shaped pieces of paper onto a balloon and then blowing the balloon up to full size. The galaxies retain their dimensions while space stretches out between them, like the skin of the balloon between the pieces of paper. Care should be taken to explain that this is not what is actually happening; the balloon merely represents one plane expanding; the universe is, of course, three dimensional in size.

10. This arithmetic example will show why our earth units of measure are inadequate in space. It is 666 air miles between Philadelphia and Chicago. Compute the distance in feet. Then compute the distance in inches.

```
     5,280
  x    666
     31680
    31680
   31680
 3,516,480 ft. - distance in feet between
                 Phila. and Chicago
```

```
 3,516,480
  x     12
   7032960
  3516480
42,207,760 in. - distance
                 in inches between
                 Phila. and Chicago.
```

Why don't we use earth miles for space measure? For the same reason that we do not measure distance between cities in feet and inches; the unit of measurement would be too small.

11. As mentioned earlier, astronomers use the astronomical unit (A.U.) when computing distances in the solar system. The average distance of the earth from the sun is approximately 92,870,000 miles from the sun; because the earth's orbit is elliptical, the actual distance varies from 91,400,000 to 94,600,000 miles.
Saturn is 9.54 A.U. from the sun.
The extreme diameter of Pluto's orbit is 7,300 million miles, or 79 A.U. This unit is too small when measuring distances between the sun and the nearest star. Have children compute the astronomical units of other planets.

12. Let us picture a scale model of the solar system. A globe two feet in diameter will represent the sun; we will put in some of the planets, making them the right sizes and distances according to our scale. Mercury will become a grain of mustard seed 83 feet away from the sun; the earth will be represented by a pea at a distance of 215 feet. Jupiter will be represented by an orange one-fifth of a mile away from the sun, and Pluto will be a pin's head at about two miles.
The star nearest our sun will be 10,000 miles away from the two foot globe.
This shows that the earth scale that we use in miles is much too small a unit when we are working with the universe.

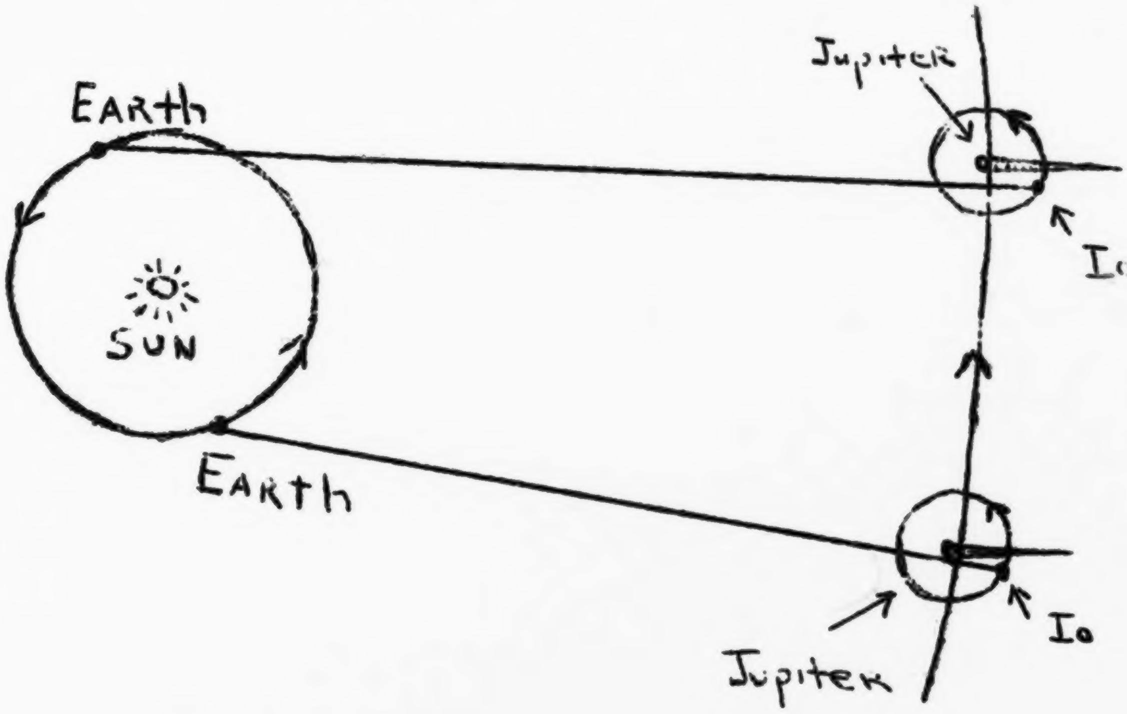
13.* The first attempt to measure the velocity of light was made by the Danish astronomer Claus Roemer in 1675. Roemer made observations of the eclipses of Jupiter's satellites, especially the moon Io. After watching the satellite go into eclipse behind Jupiter, he worked out tables by which the time of the eclipse could be accurately predicted. The chief trouble was that the eclipses did not agree with the timetable but gradually got out of step with it.

Roemer noticed that when the earth was moving away from Jupiter, so that the distance between the two planets was increasing, the eclipses kept coming later than the predicted time, whereas when the earth was approaching Jupiter the eclipses occurred earlier than predicted. Roemer correctly interpreted this as being due to the fact that the light by which we see the eclipses takes a definite time to travel across the earth's orbit.

That is, as the distance is increasing the arrival of the light is delayed by the extra distance it has to travel. When the two planets are approaching, the distance is continually decreasing; we are moving forward to meet the light and the eclipse, so to say, arrives earlier.

Roemer deduced that the time required for the light to cross the 186 million miles of the earth's orbit was 20 minutes, which gives for the velocity of light a value of 156,000 miles per second.

We now know, through better measurements, that Roemer's estimate was too conservative; light travels through space with a velocity of 186,000 miles per second.



This chart could be made to show graphically how Roemer measured the speed of light.

14. Why was Galileo unsuccessful in determining the speed of light? He had men with lanterns equipped with shutters stationed on two hilltops that faced each other across the valley in which the city of Florence lies. The distance between these hills was several miles. On taking their positions after dark with lanterns lit, but shutters closed, one group uncovered their light so that the other group could see it. Upon the very instant that the others saw the gleam they returned the signal by uncovering their lamp. The first group attempted to observe the interval between the uncovering of their own light and their seeing the signal from the hill opposite.
Little did Galileo dream that the speed of those flashes of light was such as to take them a distance of eight times around the entire earth in one second of time, 186 thousand miles!
Thunder and lightning may be discussed at this point. The children hear the thunder after the lighting flashes. This is because sound travels so much more slowly compared to light; sound travels one fifth of a mile a second (1,129 ft.) and travels approximately a mile in five seconds.
This explains the old device of counting the seconds between a lighting flash and the sound of thunder and then determining how far away the lighting flash was.

15. A light year is the distance that light travels in space, travelling at a velocity of 186,000 miles a second every second of the year. Have the children convert a light year into miles. Since light travels 186,000 miles a second, and there are 60 seconds in a minute, 60 minutes in an hour, 24 hours in a day, and 365¼ days in a year, these numbers come to approximately 6 thousand billion miles!
The distance from the earth to the moon is 1.2 light seconds.
Light travels from the sun to the earth in 8 1/3 light minutes.
Light travels from the sun to Pluto in 5.25 hours. Our solar system is .001 of a light year in diameter.

16. The star nearest to the sun, Alpha Centauri, is a little over four light years away and is our nearest stellar neighbor. (This star, is located low in the southern skies and is not visible from the United States or Europe.) Have the children write the distance in miles to the nearest star; twenty-four thousand billion (24,000,000,000,000) miles away. The scientists who launched earth satellites in 1958 gave them a speed of 18,000 miles an hour. If we could get a rocket ship to travel that fast, it would take us about 160,000 years to make the trip to the nearest star.
Space beyond the solar system is so vast that it is unlikely that man will ever venture beyond it.

17. Find a picture in a science book of the Crab Nebula. It is the expanding debris of an exploding star and is a powerful radio source from space. The Crab Nebula is four thousand light years away and was first seen by the Chinese in A.D. 1054. If the light of the explosion of this star was first seen on the earth in A.D. 1054 and took four thousand years to reach us, when did it really explode in space? It actually exploded in 3054 B.C.

18. Our nearest galaxy in space, The Andromeda Galaxy, is over 2,000,000 light years away. (Various reference books list 1,500,000 light years away; this difference shows that scientists, interpreting the same facts, draw different conclusions.) This means that light

traveling to the earth from the Andromeda Galaxy takes 2,000,000 years to reach our eyes; during all of this time, the light has traveled 186,000 miles per second every second of the time.
If we look at the Andromeda Galaxy, we are actually looking backward in time. We are seeing it as it was two million years ago.
The Andromeda Galaxy is one of the galaxies that belong to our local cluster of galaxies.
Let one inch represent a light year. How many feet would be needed to represent 2,000,000 light years? How many miles long would the paper have to be?

19. Our galaxy, the Milky Way galaxy, has a total diameter of 100,000 light years. The center is 30,000 light years away from us.
The disc (seen edgewise) has a central thickness of 20,000 light years and gets smaller toward the edge; at the location of our sun, which is two-thirds of the way out toward the extreme edge, the disc is perhaps 3,000 light-years thick.
Models of our galaxy can be drawn and the location of our solar system in it shown.

20. Stars are divided into classes, called magnitudes, of apparent brightness. The rule for magnitude is: "the fainter the star, the greater the magnitude." A star of magnitude 3 is fainter than a star of magnitude 2. The brightness of a star that is one magnitude below first magnitude is called zero magnitude. The brightness of a star that is one magnitude below zero magnitude is called -1 (minus one) magnitude. The brightest star in the night sky, Sirius, has a magnitude of -1.58.
Our sun, a medium sized star, the brightest object in the sky has a magnitude -26.72; our sun has such a low magnitude because of its relative closeness to our earth.

21. The magnitude scale has no direct connection with a star's real brightness (or its luminosity). The brightness that we see when we look at a star in the sky is only how bright it looks from where we are. A star may appear bright because it is relatively close to us in space or because of its actual luminosity.
A small bulb in your night lamp shines brighter than a street lamp down the street even though the street lamp is larger and brighter. Feel the heat put out by a small bulb held close to a person's hand. Notice how the heat lessens if the bulb is held farther back. By comparing a small bulb held close and a larger one held farther back, the ideas of apparent brightness (magnitude) and actual brightness (luminosity) may be developed.

22. Compare the brightness of a 15-watt bulb held close to a 40-watt bulb held at a distance. If possible, large distances (hallway, playground) should be used. The children will see that the smaller bulb is apparently brighter than the larger and would be given a lower magnitude number but that actually the larger bulb is more luminous. Have the bulbs held next to one another; now the 40-watt bulb will have a lower magnitude number.

23. Cover a dime and a silver dollar with aluminum foil. Hold the dime close to the eye and the silver dollar farther back; discuss the reason for the smaller coin appearing larger (brighter) and the reason for the larger coin appearing smaller (and less bright).

24. A star's temperature determines its color. The fact that stars are actually different colors usually comes as a surprise to most children. Discussion could be limited for clarity to red, yellow, and blue stars. Blue stars are believed to be hotter than yellow stars, which in turn are hotter than red stars. Children who are interested and able may study the "life" cycle of a star.

25. This experiment will show how astronomers find the temperatures of stars. Hold an iron nail with a pair of pliers over a gas flame. The color of the nail will change as the temperature changes. The nail when cold is grayish-blue. As you heat it longer and longer, it turns from dull red to bright red, to orange, and finally to yellow. If heated to higher temperatures, which you cannot get with your gas flame, the nail would continue to change to white and last to blue-white.
Through a telescope, stars are seen to have different colors. Astronomers believe that the color of the star is a clue to its temperature. The blue stars are the hottest; the blue-white are cooler; the yellow stars are still cooler, while the red stars are the coolest.
Our sun, with its yellow color, has a medium temperature for a star.

26. As the stars seem fixed on the sky sphere, groups of stars keep their shape, and we can learn to recognize them. We call these groups of stars constellations. The people who lived thousands of years ago gave the constellation names to match their shapes and made up legends to describe how the familiar objects, animals, and human beings were put into the sky sphere.
There are many sources of star legends and children enjoy reading and telling about them.

27. Children could make simple star maps and locate some of the more common constellations. They should be encouraged to look at the stars at night and locate the North Star, the Big and Little Dipper, etc. Many books (see bibliography) are available that interested children may use as guides. Star maps can be obtained commercially, also.

28. Star groups may be shown on the inside of an umbrella. The handle may represent the axis of the earth. Chalk or paint could be used to indicate the stars.

29. Cut the end off a shoe box. Cut several pieces of paper the size of the end of the box. Punch holes in the paper to represent stars. Place a flashlight in the box, put the lid on and hold one of the papers over the cut out end. Darkening the room heightens the effect.

30. Constellations may be shown by punching holes in a sheet of paper and placing the paper against a bright window, or tape these sheets of paper to the sides of a large tin can, punch holes through the paper and the can, and place a source of light inside the can.

31. Astronomers use the constellations as handy points of reference when referring to astronomical bodies; e.g., the Big Dipper is in the Constellation Ursa Major (the Great Bear).

32. A natural tendency is to think of stars in a constellation as being close together in the sky. Reference should be made to the causes of the apparent brightness of stars mentioned earlier. A star which appears to the naked eye to be close by another star may be a much larger star much farther away.

33.* A. The most common element in the universe is hydrogen. Our sun and other stars are giant nuclear furnaces in which four hydrogen atoms are changed by great heat and pressure into one atom of helium plus energy. When the four hydrogen atoms are changed to one of helium, there is a loss in mass. Matter has been changed into energy; the matter has been changed to light and heat.
The process by which this takes place is called a thermonuclear reaction; thermo means heat and nuclear pertains to the core of the atomic nucleus containing the protons and neutrons. This thermonuclear process is called fusion; lighter atoms have been fused into heavier ones with great energy being released.

B. About half of our sun's mass is made up of hydrogen. The sun burns approximately one billionth of one per cent of its mass in a year; the sun, therefore, will continue to pour out energy for many billions of years before it consumes its hydrogen.

C. Start a discussion about this. If hydrogen is the most common element in the universe, why is it that the most common element on the earth is oxygen? Scientists believe that when the earth was young, it was much hotter than it is today; the heat of the earth made it possible for the light hydrogen molecules to attain escape velocity from our earth. (An oxygen atom is sixteen times heavier than a hydrogen atom.)
Why is the moon a satellite withour an atmosphere? Gas molecules, like rockets need 25,500 miles an hour to escape our gravity, so the earth has held its atmosphere because of its greater gravitational pull. But the gas molecules, needing only a velocity of 5,500 miles per hour to escape the moon, escaped into space; the gravitational pull of the moon was unable to hold onto its gas molecules.

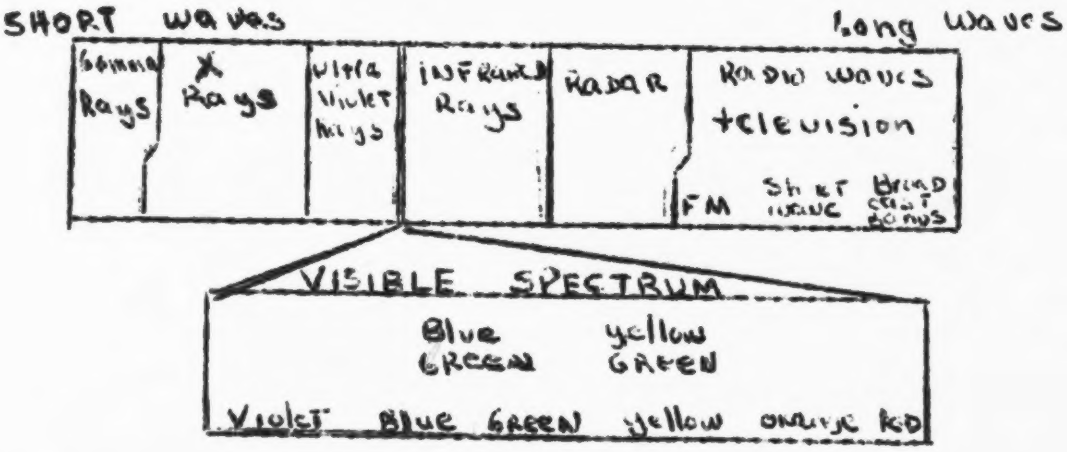
34.* Man has learned to duplicate the thermonuclear process on the earth in the hydrogen bomb; this is an uncontrolled nuclear reaction. Scientists are attempting to create controlled thermonuclear power on the earth for peaceful purposes. The sun started fusing hydrogen billions of years ago; now we are learning from its example.

35.* Energy is sent out from the sun and other stars in many different forms. Light is but one form of the sun's energy. The entire range of this energy is called the electromagnetic spectrum. This range of energy ranges from the very short gamma rays to the longer radio waves.

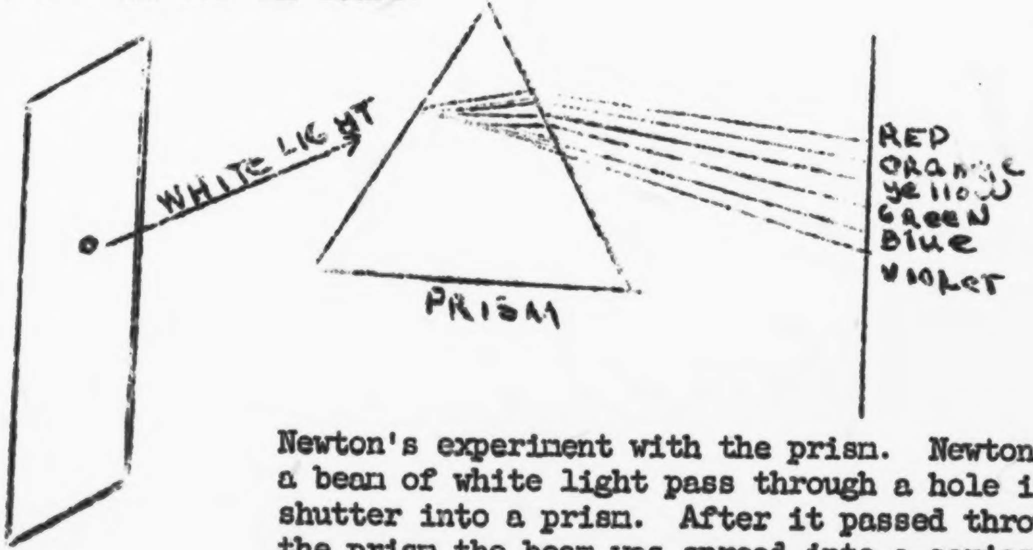
36.* Our eyes can "see" (are sensitive to) only a small portion of the sun's energy. The visible part of the spectrum; the part of the radiation that we can perceive, we call light.

37. Here is a chart of the electromagnetic spectrum; notice what a short range to which the human eye is sensitive.

Make a chart of the electromagnetic spectrum using color. Most reference books show the visual spectrum in color.


SHORT waves
Long Waves
Gamma Rays
X Rays
Ultra Violet Rays
INFRARED Rays
RADAR
RADIO WAVES
television
FM
Short wave
Broad cast bands
VISIBLE SPECTRUM
Blue GREEN
yellow GREEN
Violet
Blue
GREEN
yellow
orange
RED

38. Perform Isaac Newton's experiment with a triangular glass prism. When the white light shines through the prism, the light that comes out is no longer white but appears as the colors of the rainbow -- violet, blue, green, yellow, orange, and red. This series of rainbow colors is called a spectrum. Newton noticed that some rays were bent more than others, the violet rays being bent (refracted) the most and the red the least.


WHITE LIGHT
PRISM
RED
ORANGE
yellow
GREEN
Blue
Violet

Newton's experiment with the prism. Newton let a beam of white light pass through a hole in the shutter into a prism. After it passed through the prism the beam was spread into a series of rainbow colors on the opposite wall.

39. The above experiment can be performed with a diffraction grating replica; a diffraction grating replica is a device used in place of a prism for studying the spectrum. A diffraction grating replica may be obtained free at the Edmund Scientific display during Schoolmen's Week at their display counter. It is about two square inches in size; when held toward a light source, it breaks light up into a spectrum.

40.* Ninety-five per cent of the sun's energy output is light; the remaining five per cent is invisible. Ultraviolet and infrared are two kinds of invisible radiation; we can feel infrared energy as heat and feel the effects of ultraviolet energy as sunburn.

41.* Tell the children how man is utilizing both infrared and ultraviolet light. A Chicago department store has strung infrared lamps above its display windows so that people may be warm as they view window displays in the winter.
Film sensitive to infrared is being marketed; objects that reflect infrared radiation will show up clearly in the photographs. Diseased plants that cannot be identified in visible light reflect infrared radiation in photographs. By taking pictures of fields in infrared, the farmer can immediately identify diseased plants. Ultraviolet light is being used in hospital operating rooms because ultraviolet energy kills many germs. Ultraviolet radiation can make some things glow or fluoresce. A child that has an ultraviolet lamp and fluorescent materials can perform some interesting experiments for the class.

42.* Tell the children about the interesting experiment performed by William Herschel. In a beam of light transmitted through a prism, he held a thermometer beyond the red end of the spectrum. The mercury climbed; plainly some form of invisible radiation existed at wave lengths below the visible spectrum. The radiation Herschel had discovered became known as "infrared" -- below the red. A German physicist explored the other end of spectrum and discovered "ultraviolet" (beyond the violet).

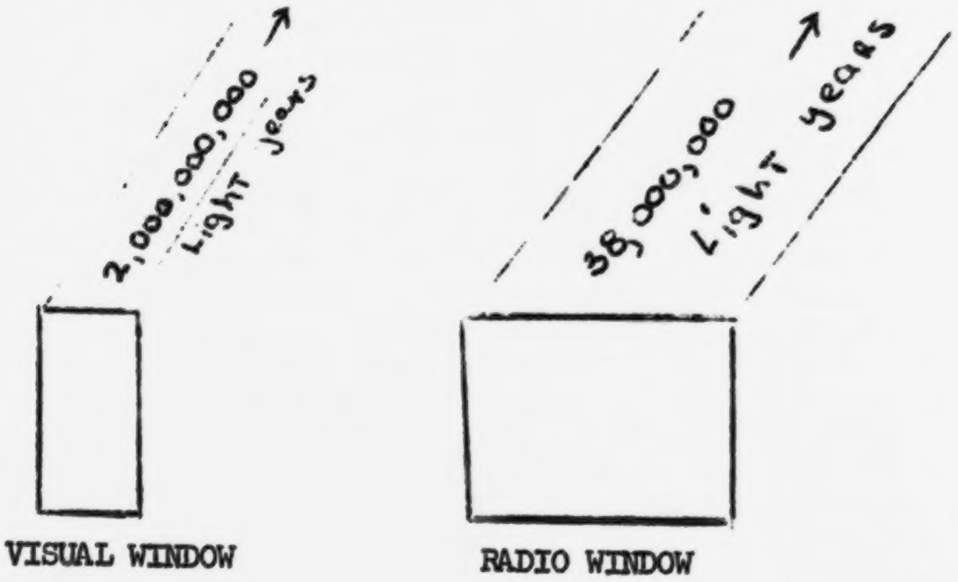
43.* Notice a rainbow. A rainbow is caused by sunlight passing through droplets of water which act like tiny prisms.

44. A telescope is a device for gathering light. There are two ways of doing this. One is to use a glass lens that is thicker at the center than at the edges; the glass bends or refracts the rays of light passing through it so that they come to a common point or focus where the image is formed. This type of telescope has a lens in the end and is called a refracting telescope. In the second type of visual telescope, instead of a lens a mirror is used to bring rays from a distant object to a focus to form an image. The mirror is shaped like a saucer. A telescope of this type is called a reflecting telescope.
Have the children do research on the two types of visual telescopes and make diagrams of them.

45. Look at the diagram of the electromagnetic spectrum. Notice how much wider is the radio wave band compared to the visual one. This means that by using radio telescopes, man should be able to probe farther into space with radio waves than with light waves. Light waves and radio waves are two forms of the same kind of energy; this energy is caused by the motion of atoms that make up all things. Many objects in outer space also "broadcast" powerful radio signals, but these objects are so far from us that the signals which reach earth are faint and weak. Radio telescopes collect the weak signals, focusing their energy into a small area. Then the signals are brought into a radio receiver where they are greatly amplified. (See activity #47).

46. A great radio telescope is being built at Sugar Grove, W. Va., and will be finished in 1964. It will have a huge metal bowl 600 feet across (the length of two football fields).
When the Hale telescope at Palomar Observatory was completed, it was supposed to look into space at a distance of 2,000,000,000 (billion) light years; the range of the radio telescope at Sugar Grove will be 19 times greater than that: How many light years is that? Have the children collect pictures of radio telescopes that appear in the picture magazines.

47. Make this chart to compare the width and depth the most powerful visual and radio telescope will be able to probe.

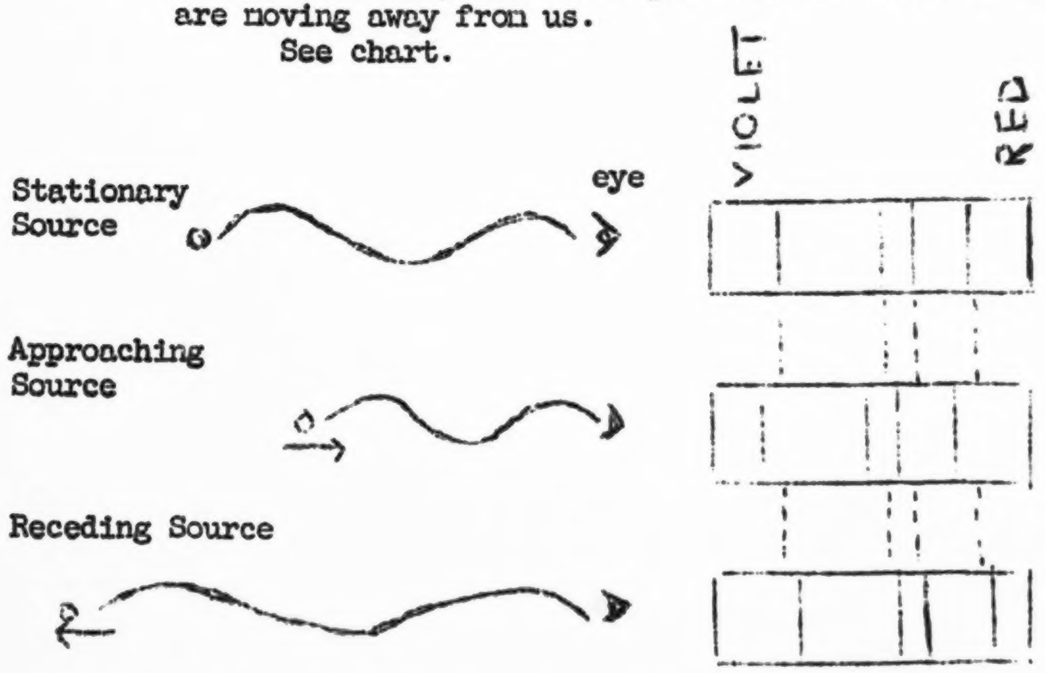


48.* According to the British astronomer, Fred Hoyle, our sun is between 4 to 5 billion years old. Recently astronomers at the Mount Palomar observatory by using the radio telescopes as a "pointer" have photographed with the 200 inch Hale telescope galaxies in collision 6 billion light years away. (When the Hale telescope was built, 2 billion light years was thought to be the ultimate range for it.) What are the implications of this?
The light from the distant galaxies started on its way to the earth before there even was an earth or sun!
It will take millions of years for the two great systems of stars to sweep through each other, and it is most unlikely that even a single pair of stars will actually come into contact, so vast are the distances between them. The collision of the gas clouds between

the stars generates the violent radio activity that our radio telescopes can pick up.

49. Listen to the radio waves from the universe! Turn on the radio with the volume turned full up and no station tuned in. Some of this familiar hissing sound originates in the set itself but part of it are radio waves from outer space picked up by the antenna.

50. A spectroscope is really a viewing lens and a prism. We can experiment with a prism and a light from our sun without a viewing lens. Attached to a viewing lens, it can reveal the temperature, composition, and movement of a star. Scientists can tell by the use of the spectroscope if galaxies are coming toward us or going away from us in space; they make use of the Doppler effect.
An Austrian scientist first made mention of this effect with sound: the pitch of the whistle of a passing locomotive rises as it approaches and drops in pitch as it recedes. This change in pitch is due simply to the fact that the number of sound waves striking the eardrum per second changes because of the source's motion.
This can also be applied to light waves. When light from a moving source reaches the eye, there is a shift in color when the source is moving fast enough. For instance, if the source is traveling toward us, more light waves are crowded into each second and the light perceived shifts toward the high-frequency end of the visible spectrum --the violet. If the source is moving away, fewer waves arrive per second and the light looks redder. This is known as the "red-shift."
Astronomers have found that the Andromeda galaxy is moving toward us at approximately 125 miles per second. Most of the other galaxies are moving away from us.
See chart.



The Doppler effect. The lines in the spectrum shift toward the violet (left) when the source is approaching. When the source recedes, the spectral lines shift toward the red end (right). Diagrams in color showing the Doppler effect can be made.

51. Children enjoy figuring out their address in the universe:

John Doe
200 Winding Way
Bala-Cynwyd
Pennsylvania
U.S.A.
Earth
Our Solar System
Our Galaxy
Our Supergalaxy
The Expanding Universe

52. If possible, have the children look through a telescope. If this is impossible, a good pair of binoculars may be used. The children should be warned never to look at the sun through a telescope or binoculars. (Astronomers use special darkened lens for this purpose.)

53. Radio astronomy began in the early 1930's. It has only become important since 1946. Comparatively new encyclopedias could be used as a basis of reports and discussion.

54. Children could report on the 200-inch Hale telescope or the large Jodrell Bank radio telescope recently built in England.

55.* Reference could be made to the very fast films now on sale that allow us to take indoor pictures under normal lighting conditions.

56. Recently astronomers doubled their estimates of the distance of certain stars. Children should be encouraged to bring in stories about space that frequently appear in newspaper and magazines.

57. The first artificial satellite was launched in 1957. Since then, many others have been sent aloft; some into orbit about the earth, some into orbit around the sun. Satellites travel in the elliptical orbits described by Kepler.

Satellites stay in orbit around the earth due to two main forces. As a satellite swings around the earth, centrifugal force is pulling it away into space; the gravitational force of the earth keeps tugging it back. These two forces must be equal for a satellite to remain in orbit. (Interesting plastic tops and toys that utilize centrifugal force can be used profitably in the classroom.)

Satellites have taught us many things about the nature of our universe --such as radiation, micrometeorites, cosmic rays, the Van Allen radiation belts.

Astronomers look forward to the day when a telescope will be put on the moon; there, unhindered by any atmosphere, astronomers will get their first clear view of the universe.

Telestar is man's beginning attempt to use satellites in earth communications; television programs are beamed to the satellite which boosts the signal ten billion times and sends it across oceans and continents. Telestar and the Venus probes as reported in our daily newspapers can be excellent motivational beginnings for the children to do independent research in these areas.

GRADE 6

RESOURCES

Fels Planetarium Franklin Institute Building, 20th and Parkway, Phila.,Pa.
Contact: Mrs. Olley -- LO 4-3600. Cost - 20¢ per child.

FILMSTRIPS

487-5 Stars and Galaxies (SVE)
487-6 Constellations "
487-7 Work of Astronomers, Space Travel "
427-16 You and the Universe "

RESOURCE PEOPLE

An Amateur Astnonomer

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Grade 6

AVIATION

The study of aviation provides the children with first hand information about travel in the "Air Age" in which we live. The principles of flying, the types of aircraft, and some of the instruments used on them are the areas presented. The problems involved in learning about how the invention of the airplane has changed our lives, how airplanes are made safe, how pilots' licenses are issued, and how air travel is controlled involve many different skills, knowledge, appreciations and attitudes.

CONCEPTS

The wings of airplanes provide lift to overcome gravity.(1-2-3-4-5--6)
The propellers' function is to pull the airplane through the air.(7)
Stability is built into a plane through the vertical fin.(8)
The course of a plane may be altered by the movement of hinged surfaces.(9)
SPECIAL STRUCTURES ENABLE AIRPLANES TO FLY AND MANEUVER.

An altimeter is used to measure altitude.(10)
A magnetic compass is used to determine direction in air travel.(10)
An air speed indicator is used to tell speed of plane through air.(10)
Automatic pilots are used to rest pilots on long flights.(10)
INSTRUMENTS ARE IMPORTANT IN AIR TRAVEL.

In contact flying, the pilot observes known land marks.(11)
In dead reckoning, direction, speed, and time of flight are used to determine position.(12)
In celestial navigation position is determined by reference to heavenly bodies.(13)
In radio navigation, the pilot follows directional flight path provided by radio range stations.(14)
THERE ARE DIFFERENT WAYS TO NAVIGATE IN THE AIR.

Planes are used for transportation.(15-16-17-18)
Planes are used for recreation.(19)
Planes are used for crop dusting.(20)
Planes are used for delivering mail.(21)
Planes are used for observation and emergencies.(22)
Planes are used for military purposes.(23)
AIRPLANES ARE USED FOR MANY PURPOSES.

Helicopters use rotating blades in place of wings to overcome the pull of gravity.(24)
Jets do not need propellers as they use expanding gases to push plane.(25)
Atomic powered planes will overcome the fuel limit problem.(26)
Rockets carry their own combustible materials and can go into space.(27-28-29)
NEW TYPES OF AIRCRAFT ARE BEING DEVELOPED.

The sound barrier is an obstacle to air travel.(30)
The heat barrier is an obstacle to air travel.(32)
New designs and materials are overcoming physical barriers.(31-33)
Man has physical limitations in air travel.(34)
Space suits enable human beings to withstand abnormal conditions.(35)
CHANGES ARE NECESSARY TO IMPROVE AIR TRAVEL.

MATERIALS

Balloons
Fans (electric)
Laboratory flask
Small flat bottle
Baking soda
Model airplanes
Carton and dividers
2-holed stopper
Cork
Shirt cardboard
Kite
Knitting needle
Source of heat
Vinegar
Carbon dioxide tubes
Wooden paddle with ball attached by 2' rubber band

TEXTBOOKS

1 - 6 : 234-255
2 - 6 : 73-91
2 - 6 : 333-338
3 - 6 : 215-239

ACTIVITIES

1. As an introductory activity it should be noted that there are basically two types of aircraft: the lighter than air and the heavier than air. The children should have observed balloons floating in air, but if possible, blow up a balloon and put it over a warm radiator so the air within it expands; this should cause the balloon to rise to the ceiling. This shows that objects lighter than air will float because of the bouyant effect of the air. A plastic plane can be dropped to show there are heavier than air aircraft. A deflated balloon can also be dropped to show that size and weight determine the bouyancy of an object. Doing the two activities without explanation would stimulate the children to come to the same conclusion.

2. Models of lighter than air craft can be brought to class and reports can be given. The Von Hindenberg disaster should be mentioned and the fact that helium is now used in place of hydrogen in lighter than air craft. The various ways lighter than air craft are still being used may prove to be quite interesting.

3. The fact that planes are heavier than air tells us that something must counteract the pull of gravity. The shape of the wing causes a reduced pressure area to develop on the upper surface and the regular pressure trying to get to the reduced pressure area causes an upward force termed lift. This can be shown by flying a kite or by planing a small kite in front of a fan.

4. A piece of paper in the shape of a wing (an empty book of matches) with a knitting needle in the leading edge will behave like a wing when exposed to wind.

5. An artificial wind tunnel can be made by having a fan back of a cutaway bottom of a grocery carton that has corrugated separators. These direct the flow of wind in a straight line. This can be used to test "model wings" made by the students.

6. Two demonstrations of the effect of wind on a surface. Have a student blow between two sheets of paper held side by side, one in each hand. They will not separate because air pressure forces them together. Have a student place a ping pong ball on a bubble pipe and blow. Why is it impossible to blow the ball off?

7. Stick figure model airplanes using rubber bands to turn the propeller can be used to show how the propeller pulls or turns its way through the air. This force is known as thrust. The amount of air or bite taken by the propeller determines how fast the plane moves. The propeller driven plane must have air.

8. A vertical stabilizer prevents rolling or turning of the plane due to propeller rotation. This may be shown on a model air plane or compare it with the stabilizer on a sail boat.

9. Make paper model airplanes with wing and rudder surfaces folded. Fly by throwing, or use knitting needles to support them, and place in front of an electric fan or your homemade wind tunnel. A model plane can again by used to show location and action of hinged surfaces.

10. The instruments used in an airplane would be impossible to duplicate in the classroom. First hand information may come in a trip to the airport. One of the more interested students could report on an altimeter, a magnetic compass, an air speed indicator, automatic pilot, etc. Other instruments suggested are a tachometer, a turn, bank, and climb indicator, a drift sight and an artificial horizon.

11. Contact flying is used for short hops over known terrain or when a pilot is experiencing difficulty with his instruments. Some recreational flyers use this method almost exclusively. If there is a definite destination, it is still a form of navigation.

12. An interesting activity for dead reckoning is to pose problems for the children, e.g., if you are in a plane heading west at the rate of 350 miles per hour, approximately where would you be in 2 hours, etc. Have each one be the navigator. This also shows how practical mathematics can be and stresses the point that it is a tool of science.

13. If a navigator has 2 or more fixed points of reference, he can figure his position. The fixed points are stars. Stars are so far away that they appear to stay in one spot. A sextant is an instrument used to determine the angle of the heavenly body. Should planets be used in celestial navigation? Why not?

14. In radio navigation the pilot depends entirely on his receiving device. If the plane gets off the flight path, the receiver indicates which way the plane must be corrected. We hope this can be explained fully in a trip to the airport.

15. Planes used for transportation: Reports and statistics may be very interesting. They could cover : number of commercial airlines in the U.S., types of planes used (propeller, jet, etc.) number of passenger accident rates, number of seaplanes used for transportation, number of companies using their own planes, etc.

16. Requirements for commercial pilot's license and possibly the requirements for an airline hostess.

17. Take a trip to the airport having a definite set of questions to be answered. Several days' discussion after the trip would be most valuable as many children will observe things others did not. Try to list safety features observed and the safety features mentioned by airport personnel.

18. A discussion of long range flights would be interesting. How far do they go between stops? At what height do they fly? How many engines do the planes have? How many passengers are carried? How regular are the flights? These are some of the phases that could be discussed.

19. Flying is becoming a very popular pastime. The aeronautics commission could give the number of planes used for recreational purposes. Some of the children may have parents or friends who fly; if so, they may be invited into the classroom. What must a person do to obtain a pilot's license? Type of tests? What are some of the standard regulations for small private planes? How much do some of the small planes cost? Are there many small airports?

20. Small maneuverable propeller driven planes are used in crop dusting. Large commercial farms find it very practical to hire "crop dusters".to do their large fields. One plane can do thousands of acres in a single day.

21. Planes are used for patrolling vast woodlands, shorelines, or for observing traffic on main arteries. The helicopter is used extensively for this type activity because it can hover over a spot almost indefinitely and can also land in a small area if necessary. There are sea planes used to patrol the coastlines. They can make rescues at sea if necessary or direct boats or ships to the rescue area. The helicopter has been used to deliver food and medical supplies to inaccessible places during emergencies. They are also used to evacuate disaster area inhabitants (fire, flood, etc.).

22. Air mail has become quite popular since the early days of World War II. We have air mail service between large cities and we also have automatic pick up devices in less populated areas. One of the students may have pictures or may have observed this and could describe it to the class. How long (number of days) does it take for an airmail letter to arrive in Los Angeles when mailed in Philadelphia? To arrive in Japan? Other sections of the world?

23. Uses of planes by the military could be discussed. It would be advisable not to permit this discussion to get out of hand or be completely dominated by the boys in the class. Fighters, transports, and bombers should be touched on to show how their function determines their design. The fact that we have changed from propeller driven planes to jets and rocket type planes in the past 10 to 15 years may help show our progress and how the military services lead commercial companies in new advances. This is particularly true during national emergencies.

24. To show the helicopter principle you must rotate a propeller rigidly. There are toys that do this. If a toy is not available, one can be constructed using a samll wood dowel that fits loosely in an empty thread spool. On one end of the spool have two small finishing nails that fit into holes centered on a wooden propeller. Place propeller on nails on spool which in turn is placed on the wood dowel. Wind string around the spool and pull quickly giving rotary motion to the propeller. If enough speed is attained, the propeller should rise showing how it pulls away from gravity.

25. Blow up a balloon, release and watch movement of the balloon. This shows the jet principle. Connecting a balloon to a boat might show how the controlled motion is used. In all jets the same blast thrusts the plane forward from the inside. The explosion is produced by the rapid burning of fuel in a combustion chamber. The differences in the various jet planes are related to the method in which the air needed for burning is admitted into the combustion chamber.

26. In the experimental atomic airplane (1958) air is taken in through air scoops and compressed in a heat exchanger. The atomic reactor heats the air into the turbo-compression engine. The hot gases, which under pressure escape from the exhaust, push the plane forward. Atomic fuel will permit planes to travel vast distances without refueling.

27. Terminology on Rockets:

Acceleration - Change of rate of speed. (A falling body picks up speed at the rate of 32 feet per second per second.)

Apogee - Outer or furthest point of an artificial satellite's orbit around the earth.

Centrifugal Force - Tendency of a satellite to be pulled outward.

Centripetal Force - Tendency of a satellite to be pulled inward.

Combustion Chamber - The motor area of the rocket where the fuel and oxygen are combined and ignited by a fuse, spark, or electrically heated wire.

Earth Satellite - A man-made body or moon revolving around the earth.

Escape Velocity - The amount of speed required to overcome gravity.

Gravity - The force of attraction by which the satellite tends to be pulled toward the center of the earth.

Jet Stream - Gases under pressure flowing from the exhaust nozzle of the rocket.

Liquid Fuel - Fluids such as gasoline, kerosene, and ethyl alcohol mixed with liquid oxygen to provide combustion for the rocket's thrust.

Lox - Liquid oxygen

Orbit - The elliptical or curved path of the artificial satellite as it travels around the earth.

Oxidizer - The liquid or solid used to provide oxygen to combine with fuel to maintain combustion in the combustion chamber.

Perigee - Inner or closest point of the artificial satellite's orbit around the earth.

Powder Fuel - Powders such as charcoal, sulfur, and saltpeter mixed and compacted for combustion. The saltpeter contains oxygen for the oxidizing agent.

Rocket - Cylindrical tube containing combustible substances which, upon being ignited, release gases under pressure propelling the tube through the air.

Stability - Ability of the rocket to maintain its original course either through instruments or fins.

Thrust - The force generated by the hot gases which, under pressure, are released through the exhaust to drive the rocket forward.

Trajectory - The curved path traveled by the rocket in its flight toward outer space.

Velocity - Rate of speed of rocket.

28. Rockets are the ultimate in flying machines. They do not rely in any way on the air sustaining their motion. The rocket engine carries its own oxygen supply for the burning of fuel and is, therefore, not limited to flight within the atmosphere. Three stage rockets are being used to hurl man-made earth satellites into their orbits. From these satellites we are learning more about the earth, the atmosphere, and outer space. If a rocket is to reach the moon, it must attain a speed of 6 miles a second at an altitude of 350 miles above the earth's surface.

29. The students may want to make a rocket. We suggest a carbon dioxide tube as the fuel. The pamphlet on rockets suggests activities.

30. When a plane moves slower than the speed of sound, the sound made by the plane speeds away from it. When the speed of sound is approached, a curious thing happens. The plane begins to shake and bounce. Going still faster the shaking increases, becoming so violent the wings are sometimes wrenched off the plane. This is due to the fact that the plane keeps pace with its own sound waves. The compression waves cannot speed away from the plane. They pile up in front of the wings and body of the plane, forming a veritable wall. When the plane attempts to move faster it must break through this wall of high pressure. At the moment of breaking through, a loud bang is often heard by people on the ground. When the plane breaks through and is flying faster than the speed of sound, the sound waves are left behind and no longer affect the plane.

31. Planes have been designed to move through the sound barrier without damage. A long, needle-like nose and thin, swept back wings enable the plane to slip through the sound barrier smoothly. The delta or triangular wing is common in craft designed for flight at supersonic speed.

32. When a plane flies through the atmosphere, air friction heats the plane's metal skin; the faster the flight, the more intense the heat. A meteorite falling 25,000 miles per hour literally boils away leaving a trail of luminous gas, popularly called a shooting star. This is the heat barrier.

33. Special alloy metals are being developed to counteract the high temperatures due to air friction. The heat generated is a menace also to the pilot, who would be roasted in his cockpit if it were not for refrigeration equipment installed in these planes.

34. The human body has limitations to air travel. Some of them are the oxygen required, temperature, pressure, need for gravity, etc.

35. Space suits for space travel help the body overcome the abnormal conditions. The pressurized cabins are also a help to the pilots. Most encyclopedias will have pictures and diagrams of the equipment necessary to man to travel in space.

Resources

1. International Airport (Phila. Div. of Aviation) Phila., SA 7-9955. Contact Mr. A. B. Brough. Guide provided for free tour (1 hour).

2. U. S. Naval Air Station, Willow Grove, OS 5-7070, Ext. 203. Contact Command Liaison - Aircraft. Consists of tour with lectures and displays. Wednesday through Saturday at 10:00 and 1:30 and 3:00.

3. United Aircraft Corporation, 900 Main Street, East Hartford 8, Conn. Write for free material on aviation and "The Age of Flight".

4. United Aircraft Corporation, Hamilton Standard Division, Public Relations Director, Windsor Locks, Conn. Prop to Pilot (on propellers) free to teachers.

5. United AirLines Inc., School and College Service, 5959 S. Cicero Avenue, Chicago 38, Illinois. Free Aviation Kit (assortment of pamphlets).

Resource People

1. Reserve Army or Navy Pilot
2. Airline pilot
3. Airline hostess
4. Airplane mechanic
5. Parent or relative of student in class who is former pilot or mechanic

FILMS

Air In Action	Radnor Film Library
Air In Motion	"
Airplanes Change Our World Map	"
Jet Power	"
Jets and Planes	"
Rockets and Missiles	"

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Clarke, Arthur C., "Going Into Space", Trend Book, 5959 Hollywood Blvd., Los Angeles, California
Ley, Willy, "The Complete Book of Satellites and Outer Space", MACO, Magazine Corporation, 480 Lexington Ave., N.Y. 17, N.Y.
Mallan, Lloyd, "Space Satellites", Fawcett Book, Fawcett Building, Greenwich, Conn.
Mallan, Lloyd, "Secrets of Space Flight", Fawcett Book, Fawcett Building, Greenwich, Conn.

LOWER MERION SCHOOL DISTRICT GRADE 6

THE HUMAN BODY

A study of the human body does not lead to as many activities as some of the other areas, but it may involve numerous experiences that require observation, investigation and personal practice.

Pupils are naturally curious about their bodies and how they work. It is hoped that study about their bodies will develop in pupils a good attitude toward them: that the human body is a wonderful machine, that the child's method of development is natural, that our main objective is to keep our bodies healthy and learn more about them so that we can appreciate them more fully.

CONCEPTS

Bones give our body its general form. (1-6)
Bone is connective tissue made hard by presence of mineral salts. (2-3-4-5)
Bones come into close contact at points called joints. (7-8)
Strong flexible tissues called ligaments hold bones together at joints.(7)
BONES GIVE OUR BODY A STRONG FOUNDATION.

The main function of muscles is contraction. (9)
Tendons attach muscles to bones. (10)
Skeletal muscles are the ones we use voluntarily. (11-12)
Smooth muscles cannot be controlled. (13-14)
Cardiac muscle tissue forms the heart. (15)
MOTION AND LOCOMOTION ARE ACCOMPLISHED BY OUR MUSCLES.

Nerve cells are called neurons. (16)
The voluntary nervous system includes the brain and the spinal cord. (12-17-18)
The involuntary nervous system includes nerves of muscle tissue, heart and glands. (17-19)
The two systems work together very closely. (17-18-19)
THE NERVOUS SYSTEM CONTROLS THE BODY.

Blood supplies food to the body cells. (20-22)
Blood supplies oxygen to the body cells. (20-22)
Blood helps fight disease. (19)
Blood is circulated by the heart. (15-21-22-23-24-25)
BLOOD REACHES ALL PARTS OF THE BODY.

The nasal passage way helps prepare air. (26)
The trachea and the bronchial tubes carry air to the lungs. (26-27)
The lungs take oxygen from air and supply it to the blood. (27-28-29)
The lungs remove waste from the blood. (27-28-29)
THE RESPIRATORY SYSTEM PERFORMS SEVERAL FUNCTIONS

Digestion begins in the mouth. (30-31-32-33-34)
The stomach is one of the principal organs of the digestive system. (34-35-36)
Digestion continues in the intestines. (30-34-36)
DIGESTION IS A CONTINUOUS PROCESS.

Ductless glands secrete materials into the blood stream. (37)
The thyroid gland is located in the neck region. (38-39)
The parathyroids are located on the surface of the thyroid gland. (38-39)
The adrenal glands are found on the upper end of each kidney. (38-39)
The pituitary is located in the brain region. (38-39)
Gonads, pancreas, pineal body and thymus are some other ductless glands.
GLANDS INFLUENCE BODY GROWTH

MATERIALS

Glass tubing	Rubber stopper	Rubber tubing
Chicken bones	Vinegar	Chicken viscera

TEXTBOOKS

2 - 5 : 256-263
2 - 6 : 164-171
3 - 4 : 67-75; 86-89

ACTIVITIES AND DATA

1. What noticable features do human beings possess that distinguish them from other forms of life? Would weight be one? Compare a sack of cement or sand weighing the same with the weight of a human being. Silhouette of a human being has what characteristics: Head, 2 arms, 2 legs, trunk, etc. What determines our general form? Bones. Muscles help in the refinement of our shape.

2. It should be explained that bones of infants are not hard because the mineral salts (calcium phosphate and calcium carbonate) have not impregnated the bones. The process of doing this is called ossification. Parents are concerned that their children do not walk too early because the bones may not be hard enough to support the weight of the child. Bowed legs can result from this early walking. Chicken bones can be placed in a vinegar solution. In a couple of days the vinegar (containing acetic acid) should have dissolved the mineral salts and the bone should be very flexible showing what the bone would be like without enough minerals. The part remaining is the living (organic) part.

3. It can be explained that deficiency of minerals or vitamins permitting use of minerals will affect the functioning of the bone. A report on rickets would be appropriate.

4. If a bone is heated sufficiently to remove all organic materials, the bone will be white, rigid and so brittle it can be crushed in the fingers.

5. Break bones of different animals and examine the exterior and interior portions. The interior is more porous and should show signs of blood vessels. The interior or living part of the bone must be nourished.

6. The adult skeleton consists of 206 bones:
   Head - 29
   Trunk - 51 (26 vertebrae, 24 ribs, 1 breastbone (sternum)
   Upper extremities - 64 (27 in wrist and hand, 2 in lower arm, 1 in upper arm, collar bone and shoulder blade)

Lower extremities - 62 (26 in foot and ankle, 2 in lower leg, 1 in upper leg, hip bone, knee cap)

Medical terms of easy-to-remember bones are:
Lower arm - radius and ulna
Upper arm - humerus
Shoulder blade - scapula
Collar bone - clavicle
Lower leg - tibia and fibula
Upper leg - femur
Knee cap - patella

Biology books and encyclopedias have labeled diagrams of the skeleton. There are also plastic skeletons (miniature) that are sold in department stores. These are helpful if available.

7. Have children bring in an uncooked chicken wing. Examine where bones are connected. This strong fibrous, somewhat elastic material, holding the bones together is called ligaments and the junction is referred to as a joint.

8. Our body has different types of joints; e.g., our shoulder and hip are ball and socket joints, our elbow and knee are hinge joints, our wrist and ankle are sliding or pivot joints as is our back, and we also have immovable joints in our cranium.

9. What do our muscles do to cause motion? What happens when we bend our arm? When we straighten it? In all cases, the answer should be that certain muscles contract or shorten. After each contraction there is a short period of relaxation before the same muscle can contract again.

10. Have a student bring in an uncooked leg of a chicken. Using lance, needles, carefully take the thin covering (fiscia) off the muscle and try to follow the muscle and see how it is connected to the bone. There should be a tough fibrous material connecting the muscle or muscles to the bone. This connective tissue is called a tendon.

11. Our upper arm muscles are examples of voluntary ones. The biceps bend the arm and the triceps straighten it. These two muscles are said to work in opposition. This is true of most skeletal or voluntary muscles. Remember the main function of a muscle is contraction. Each muscle is said to have three parts - the two ends and the belly. The belly is the part that contracts. The one end of a muscle attached to a relatively immovable bone is called the origin; the other end is attached to a movable bone and called the insertion end.

12. An athlete's being in good condition means that his muscles have good tone. Tone refers to the slight contraction of muscles when they are not being used. It means they will respond faster and stronger when called on to do a specific job. Coordination is also important and it refers to several sets of muscles working together to perform a single function. The nervous system helps time the use of our muscles.

13. Smooth muscles are found in the linings of the muscles found in our esophagus, stomach, intestines and other internal organs. The viscera of a chicken should give the children an idea as to why they are called smooth muscles. We should also know from experience that we cannot control action of these muscles. After you swallow food, you have little or no control over the physical moving of the food through the digestive tube (alimentary canal.)

14. Another example of the action of smooth muscles is the action of blood vessel muscles to keep the blood moving through. We cannot stop the flow of blood unless we can physically close the blood vessel (tourniquet).

15. The muscle tissue found in the heart is different from other muscle but it is still uncontrollable. It is the most perfect of all muscle tissue in its operation and does a tremendous amount of work. Activity would be to have the children look in encyclopedias to see how much work the heart muscle does per day, year, and lifetime. Mathematics students would enjoy figuring this out. The heart is a living pump, pushing blood through thousands of miles of blood vessels, beating 100,000 times a day.

16. Nerve tissue enters into all parts of the nervous system. Like all other tissues it is composed of cells, but the cells are differentiated from other cells. Some nerve cells extend two or three feet. These nerve cells are called neurons. Activity: Have the children make a drawing of a neuron (motor) from an encyclopedia or other reference book available. The three main parts would be the cell body, the dendrites, and the axon. It should be explained that these nerve cells move muscles when they are sent a message from the spinal cord or brain.

17. The headquarters of the nervous system is the brain. The brain's main parts are the cerebrum, the cerebellum, and the medulla. The part we hope to develop in school is the cerebrum.

    The cerebrum is the part of the brain where the centers that control consciousness, intelligence, reasoning, memory, imagination, and learning are located. The cerebrum also houses the center that receive and interpret sensations, such as sight, hearing, smell, taste, pain, pressure and others. Here also are the centers for initiating and directing voluntary activities; e.g., waving your hand at a friend, snapping your fingers, kicking, etc.

    The cerebellum is a coordinating center for muscular movements. Any action, such as walking, requires the coordinated functioning of many muscles. The precise timing of muscular contraction and relaxation is insured by the cerebellum, as is the control of balance.

    The medulla controls what might be termed the housekeeping functions of the body. Digestion, heart beat, respiration, and excretion are some of the body activities directed by the medulla.

    The spinal cord is the main pathway between the brain and the rest of the body.

18. In learning procedures if the same nerve pathways are used often enough to recall certain information, we say the child has learned the material. This is memory or rote material. Have children "learn" a list of facts. They should see that some people will do so faster than others. Habits are things repeated so often we may do them without "thinking". Dancing and some acquired skills (athletics) are of this type. Have children name habits they have. This also shows how the voluntary and involuntary nervous systems work hand in hand.

19. A reflex action is the simplest type of action of the nervous system. If unthinkingly you touch a hot object with your finger, what happens? You pull your finger away before you are aware that it is hot. The action starts with stimulation of receptors by the hot object. The heat receptors generate a nerve impulse that is carried to the spinal cord by a sensory neuron. Here connections are made to motor nerve cells. The motor nerve cells take the message to the arm muscle, which contracts, pulling the arm away. All of this takes but a few thousandths of a second. Meantime, a second series of connections are made in the spinal cord and a message starts up to the brain to advise the brain that the object was hot. This message, however, does not arrive in the brain until some thousandths of a second after the hand has been pulled away. We can see the protective advantages of these inborn automatic actions. Test reflexes using dry ice (hot ice). (Use caution.) Sometimes the reflex is so fast the sensory receptors are not sure if it is hot or cold.

20. Blood has many different components, some of them are:

Plasma - ninety per cent water, ten per cent dissolved proteins, salts, and other foods.

Cells - Red corpuscles are by far the most numerous (about 24 million in a single drop of blood.) They pick up oxygen from the lungs and deliever it to all parts of the body and pick up carbon dioxide and return it to the lungs to be dispelled.

White corpuscles are bigger and fewer than red cells. They help protect against disease by engulfing and destroying harmful bacteria.

The platelets are the smallest cells in the blood, they are responsible for clotting the blood.

Children may look up and report on words like plasma, corpuscle, hemoglobin, fibrinogin, hemophilia, arteries, veins, and capillaries.

The plastic models of the human body which show a partial circulatory system are very helpful for this part of the study.

21. Let the children feel each other's pulse at the front of the ear, the neck, the wrist. Remind them to use their fingers instead of the thumb because the thumb has a large artery and we get our own heartbeat instead of the other person's.

22. Have some of the children report about the discoveries of Dr. William Harvey and Dr. Marcello Malpighi. (World Book Encyclopedia, Compton's Pictured Encyclopedia.)

23. Obtain a beef heart from a butcher shop. Cut it in half and examine it carefully to find such parts as the auricles, ventricles, valves, muscles wall dividing the two sides of the heart, and blood vessels. A chicken heart, though small, would be worth using.

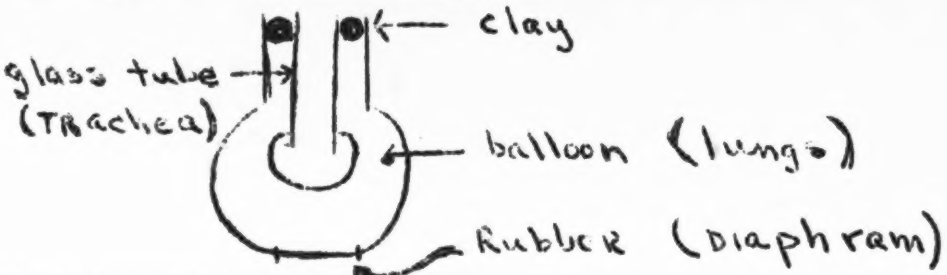
24. Make a "homemade" stethoscope. Get a narrow rubber tube, about two feet long, and a funnel.
Put the end of the rubber tube in the small end of the funnel. Put the wide end of the funnel on your chest, and the free end of the rubber tube in your ear. Listen to your heartbeat.

25. Have some of the children read and report about Dr. Rene Laennec and the invention of the stethoscope.

26. The nasal passage is the air passage through the nose. It is interlaced with a network of capillaries which warm the air. Mucous is secreted which moistens the air and catches germs and dust. Hairlike particles, called cilia, also act as filters. The air then passes into the trachea and then on into the bronchial tubes. From the bronchial tubes the air passes into the lungs.

27. To illustrate the way the trachea and lungs work, fasten two balloons to the ends of a Y shaped tube of glass. Insert the tube through the top of a bell jar with a one hole rubber stopper. Stretch a sheet of rubber over the open bottom of the bell jar and tie it tightly in place. When the sheet of rubber is pulled down, the balloons will inflate. The glass tube corresponds to the trachea, the balloons to the lungs. If the tube were attached to the inside of the balloon with a tree like network of small tubes, this hidden part would act like the bronchial tubes.

The same effect may be achieved by using a glass tube, a chimney lamp, and a ball of clay as a stopper.



28. The smallest branches of the bronchial tubes finally lead into clusters of tiny air sacs, called alveoli, that perform the real work of the lungs. Oxygen is taken out of the air and exchanged for carbon dioxide inside these tiny air sacs. Thus oxygen is breathed into the lungs and carbon dioxide is expelled.

29. Word game. Fill in the missing letters.

T _ a _ h _ _

B _ o _ c _ _ _ l

A l _ _ o _ i

L _ n _ s etc.

30. The teeth break food into small particles, and salivia acts on it chemically. When the food becomes soft enough, it is passed by (over) through the esophagus to the stomach. The stomach is lined with powerful muscles that mash and mix the food into a still finer paste. Special cells in its walls release gastric juices that continue breaking down the food into the forms that can be fed to the cells. Finally small quantities of food enter the lower intestine. Almost all the useful solid particles of food are extracted and passed to the bloodstream. The rest enter the large intestine which removes the useful liquid portion of the food and passes off the waste.

31. To show how the larynx helps the epiglottis seal off the trachea to prevent food from entering the windpipe; have the children place their fingers on their Adam's apple and then swallow. They will be able to feel the larynx move up to meet with the epiglottis. (The epiglottis is a lid made of cartilage enclosed in mucous membrane, and located at the base of the tongue over the larynx at the top of the trachea. It opens to allow air to enter the trachea, and closes to keep food out of the trachea.)

32. During a quiet part of the day ask the children to describe what their mouths feels like. Are they moist or dry? Now have them pretend they are chewing food. After awhile ask them to describe the inside of their mouths again. Ask them to tell what the tongue does as they chew. They could also describe the action of the teeth.

33. Put a whole lump of sugar in a glass of water. In another glass of water put a lump of sugar that has been crushed into small pieces. Stir each glass. The crushed sugar dissolves more quickly. This shows that when food has been cut or crushed into small pieces it can be changed more easily into liquids.

34. Research work. Some of the children could report about the discoveries of men like: Rene de Reaumur and his pet bird, Abbe Lazaro Spallanzani and his little bag of linen, Dr. William Beaumont observing a stomach at work. (Compton's Pictured Encyclopedia - World Book)

35. Have the pupils make a list of parts of the body involved in digestion using skeleton words as aids.

M _ _ t h   T _ _ t h   L _ v _ r

S _ l _ v _ _   E s _ p h _ g _ s

S m _ l l   _ n t _ s t _ n _

36. To show how the churning movements of the stomach aid in helping food dissolve:

In each of two small jars put a lump of sugar.
Fill each jar with water.
Let one jar stand still. Rock the other back and forth.
See how long it takes for each lump to dissolve.

37. Some glands have passage ways (ducts) for their secretions. Some glands do not have passage ways (ductless) for their secretions. If no passage ways are present, the glands need a transportation system for their secretions; the blood system serves this purpose. The glands get the raw materials from the blood, reassemble and put them back in the blood stream.

38. Perhaps the best way to teach the meaning of the ductless (endocrine) glands is to organize the class into committees. The thyroid committee could look up material and report to the class using many pictures to show the results of overactive and underactive glands. The same could be done with the para-thyroids (very limited amount of material), the adrenal glands, and the pituitary. Gonads, pancreas, pineal body, and the thymus can be covered in a general way; e.g., through class discussion.

39. A large drawing of a body could be placed on the bulletin board. As each gland is discussed, a small drawing of the gland could be placed on the large drawing to show its location. The associated diseases could be listed also.

RESOURCES

Our bodies
Meat markets for bones

RESOURCE PERSONS

Local doctors
Professional athletes

FILMS

Gateways to the Mind - Bell Telephone Co.
The Human Machine - Radnor Film Library

FILMSTRIPS

The Glandular System	SVE
The Nervous System	"
Your Bones	Curriculum Materials Corp.
Your Muscles	" " "

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